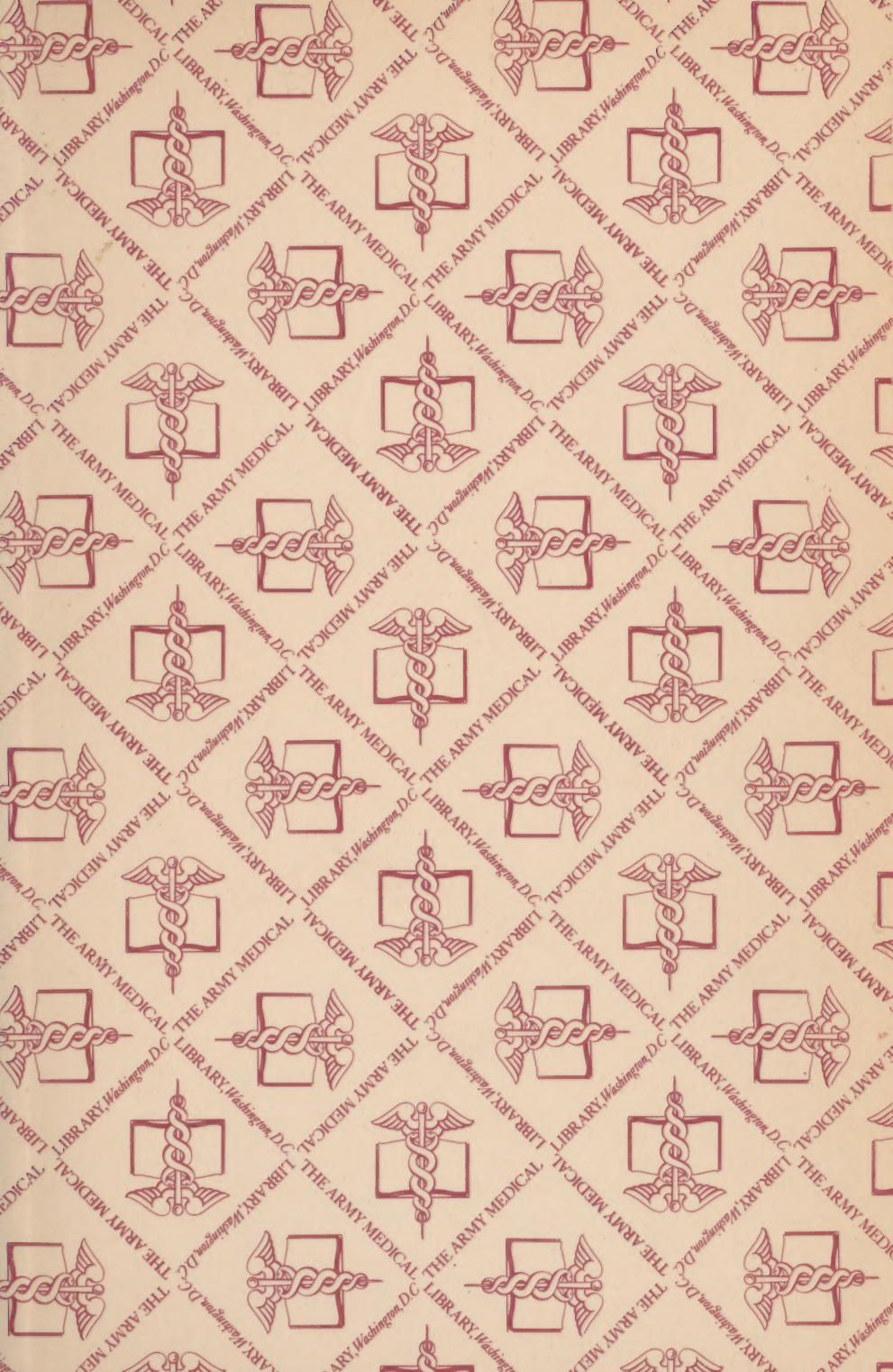
TM 3-221

WAR DEPARTMENT

TECHNICAL MANUAL

DECONTAMINATING APPARATUS M3A1

April 15, 1943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'ECHNICAL MANUAL)
NO. 3-221)

DECONTAMINATING APPARATUS, M3A1

(POWER-DRIVEN, 400-GALLON)

U.S. War Department
Washington, April 15, 1943

*This manual supersedes Section II, Chapter 3, TM 3-220, March 7, 1942, and Training Circulars Nos. 74 (Sec. II) and 109, War Department, 1942.

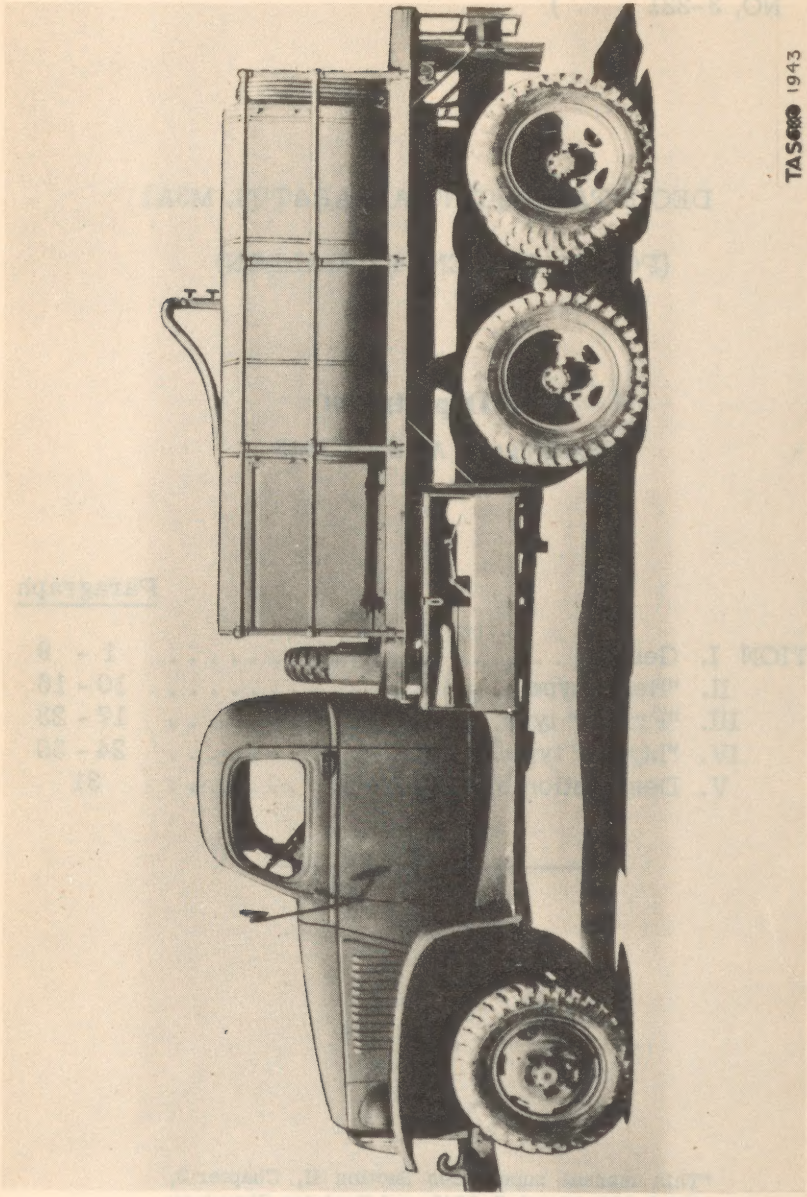

Figure 1. A Typical M3A1 (400-Gallon) Power-Driven Decontaminating Apparatus.

SECTION I

GENERAL

1. PURPOSE AND SCOPE. This manual is intended for the using services. It provides all necessary information regarding the construction, servicing, and functioning of the "Bean," "Friend," and "Myers" types of 400-gallon, power-driven decontaminating apparatus, M3A1, as well as specifications for first and second echelon maintenance for all apparatus. A final section is devoted to the demolition of equipment when circumstances force the abandonment of chemical warfare materiel in the field.

2. DESIGNS. The M3A1 apparatus is supplied by three manufacturers, and while there is much in common among the various makes, each employs its own peculiar pump and unloader, or pressure relief valve. Each is mounted on a 2-1/2-ton truck, powered by a take-off from the engine, and can spray 400 gallons of a chlorinated lime (bleach)-water mixture (slurry) in 20 minutes.

3. DISTRIBUTION. Power-driven decontaminating apparatus are normally issued to and employed by Chemical Warfare Service decontamination companies and by decontamination

squads of the Armored Force and Army Air Forces.

4. CHARACTERISTICS. a. General. The M3A1 apparatus is designed to spread effectively suspensions of decontaminating materials on large areas or large surfaces.

b. Data. Pertinent data of apparatus dimensions, filling and mixing times, area coverage, and discharge rate are as follows:

Weight of unit empty (truck and apparatus)	11,000 lbs.
Height	7 ft., 6 in.
Length	21 ft., 3 in.
Width	7 ft., 3 in.
Water per filling	225 gals.
Filling time from stream	10 min.
Bleach per filling	1,600 lbs.
Filling time with bleach	20 min.
Mixing time	15 min.
Average coverage per filling	1,600 sq. yds.
Discharge rate (1 spray gun)	11 gals. per min.
Discharge rate (2 spray guns)	20 gals. per min.

5. DESCRIPTION AND NOMENCLATURE. a. Apparatus. The apparatus is a modified commercial power-driven orchard sprayer consisting essentially of a wooden tank of 400-gallon working capacity with a rotary agitator, a piston-type pump equipped with a pressure regulating unloader, or relief valve, capable of delivering approximately 35 gallons of water per minute at a working pressure of 400 pounds per square inch, and a power take-off unit which drives the pump and agitator by means of roller chains. (See figure 2.)

b. Transportation. The vehicle used as a base for the apparatus is a 2-1/2-ton, six-wheel-drive, gasoline engine truck. The apparatus is securely mounted on the chassis with the power take-off end to the front. A working platform capable

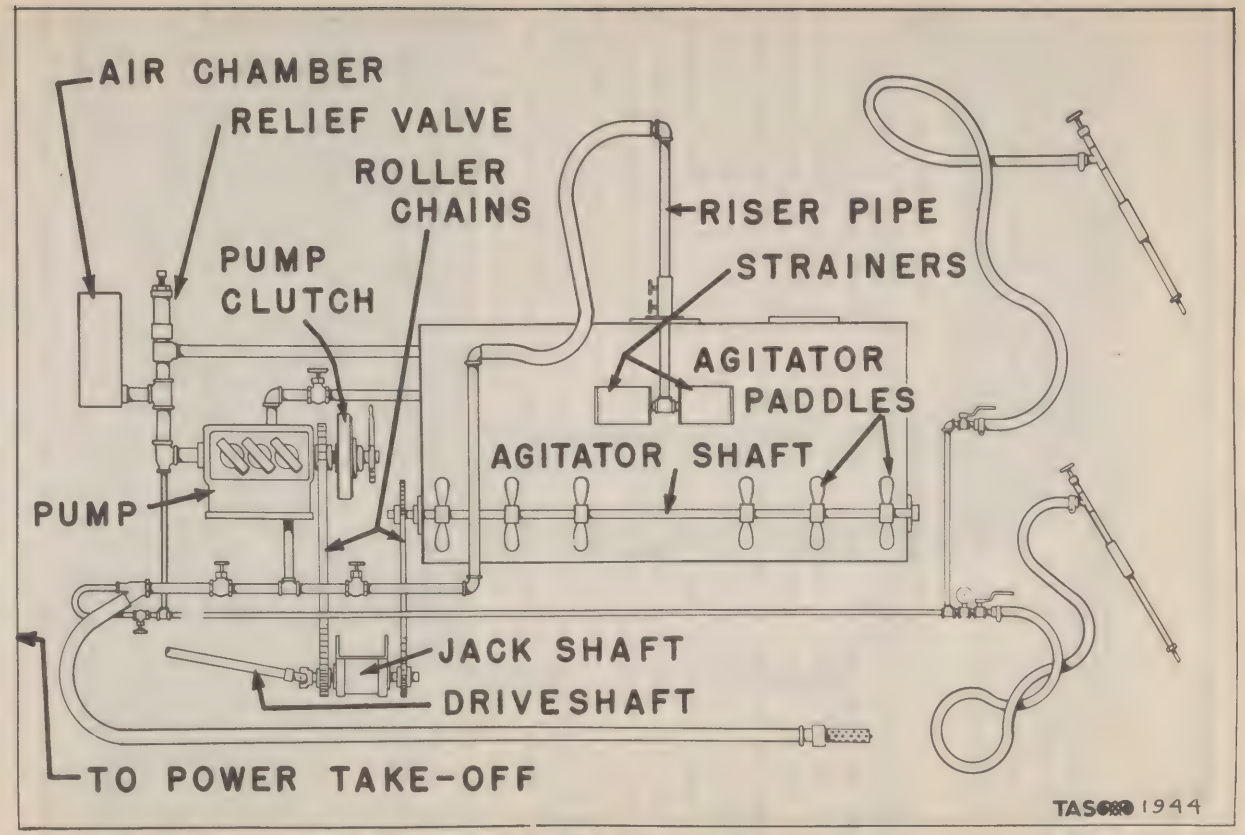

Figure 2. Arrangement of Parts in a M3A1 Power-Driven Decontaminating Apparatus.

of supporting 1,500 pounds is provided along each side of the truck.

c. Special equipment and control valves. (1) General. A proper suspension of chlorinated lime (bleach) and water is much more difficult to obtain than a suspension of commercial orchard insecticide. To prevent the nozzles from being clogged, a special strainer is incorporated in the tank.

(2) Strainer assembly. The strainer assembly consists of two cylindrical strainers with their slotted pipe supports and holding caps, a riser pipe, a cover plate, and a sleeve with two handscrews to hold the riser pipe in place. (See figures 3, 4, and 5.) The cover plate is fastened over a small manhole near the center of the mixing tank by four bolts and wing nuts. The entire strainer assembly may be removed from the tank by unscrewing the four wing nuts. (See figure 4.) The strainers may also be removed, with the remainder of the assembly in place, by unscrewing the holding caps after first lifting the riser pipe to such a height that the strainers may easily be reached from the manhole. The two hand-screws on the cover plate sleeve are used to clamp the riser pipe and strainers in position at any desired height in the tank. The sleeve is provided with a slot so that when the strainers are dropped to the lowest position the fin on the riser pipe will slide in the slot and thereby hold the strainers so that they will clear the agitator shaft.

(3) Bleach intake line. (See figure 6.) The bleach, or slurry, intake line connects the riser pipe coming from the tank with the pump. This line consists for the most part of a flexible hose which will permit the riser pipe and strainers to be raised or lowered. A bleach intake valve is located near the pump end of the line and is used for shutting off the flow of liquid from the tank to the pump.

(4) Water intake line. (See figure 7.) The water intake line is used to load water into the tank from ponds and

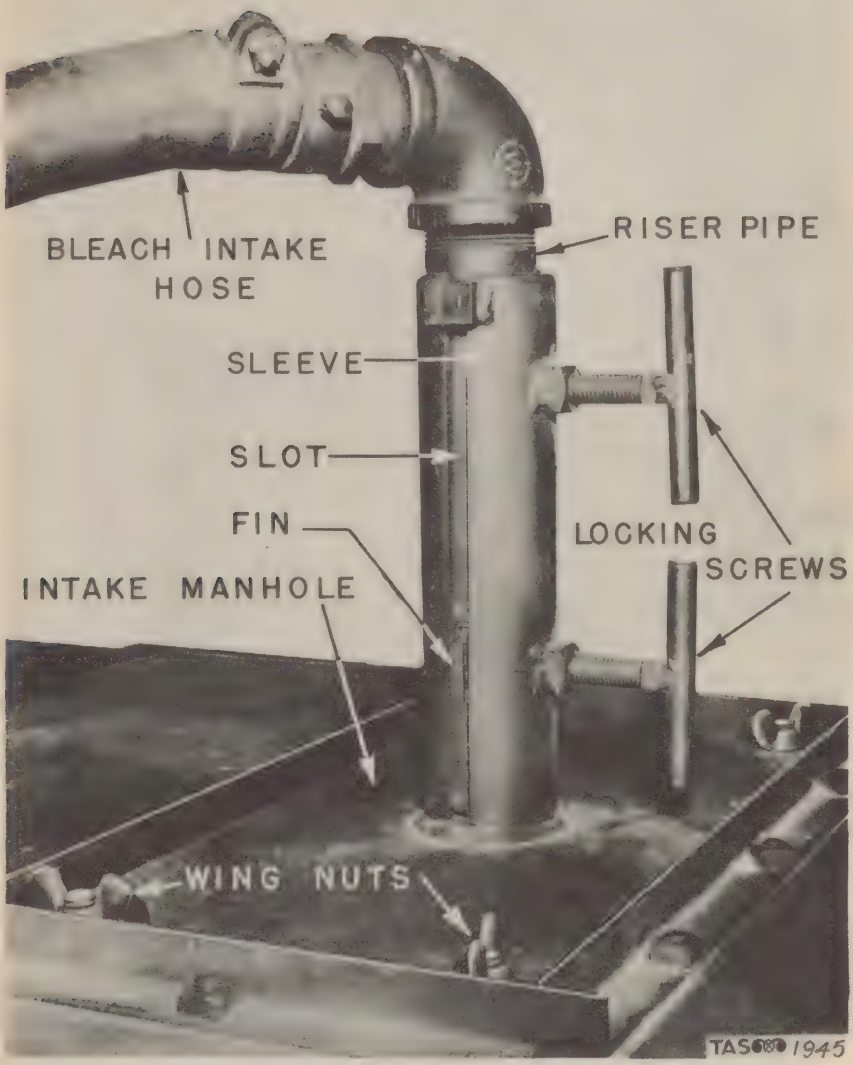

Figure 3. Exterior Parts of Strainer Assembly.

Figure 4. Typical Strainer Assembly.

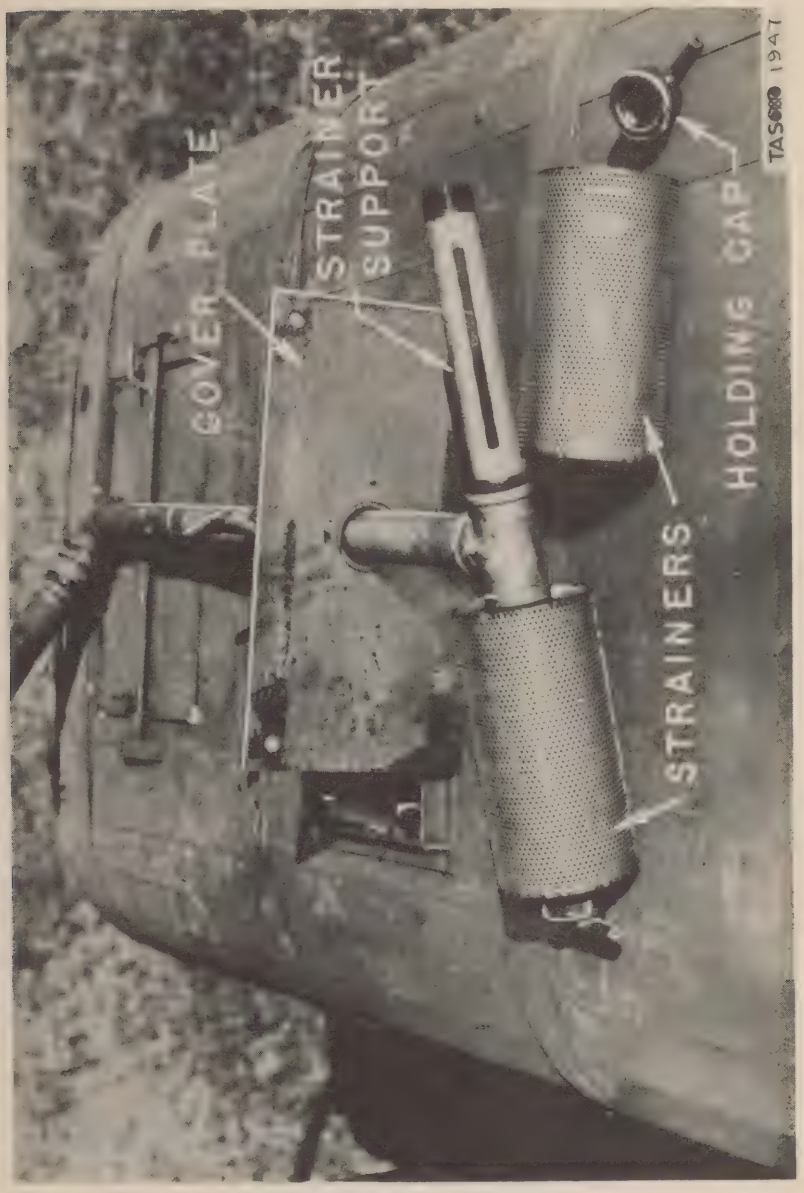

Figure 5. Strainer Assembly Dismantled.

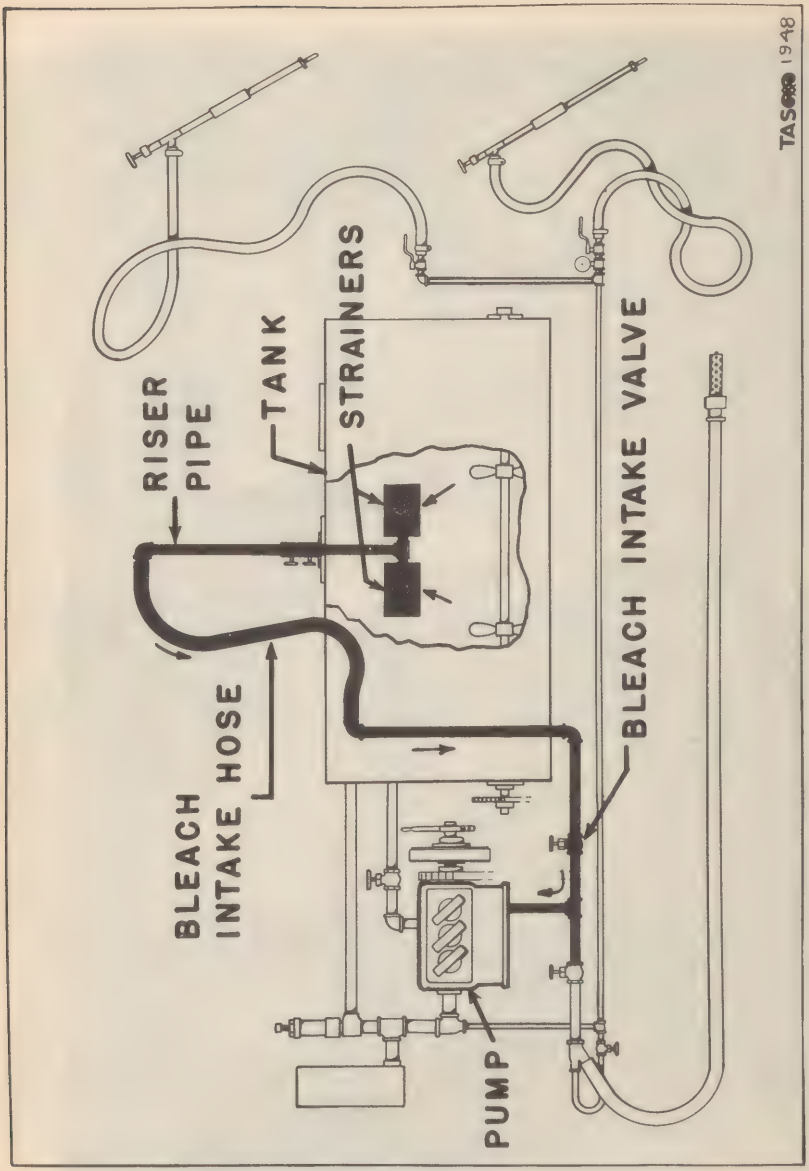

Figure 6. Bleach Intake Line.

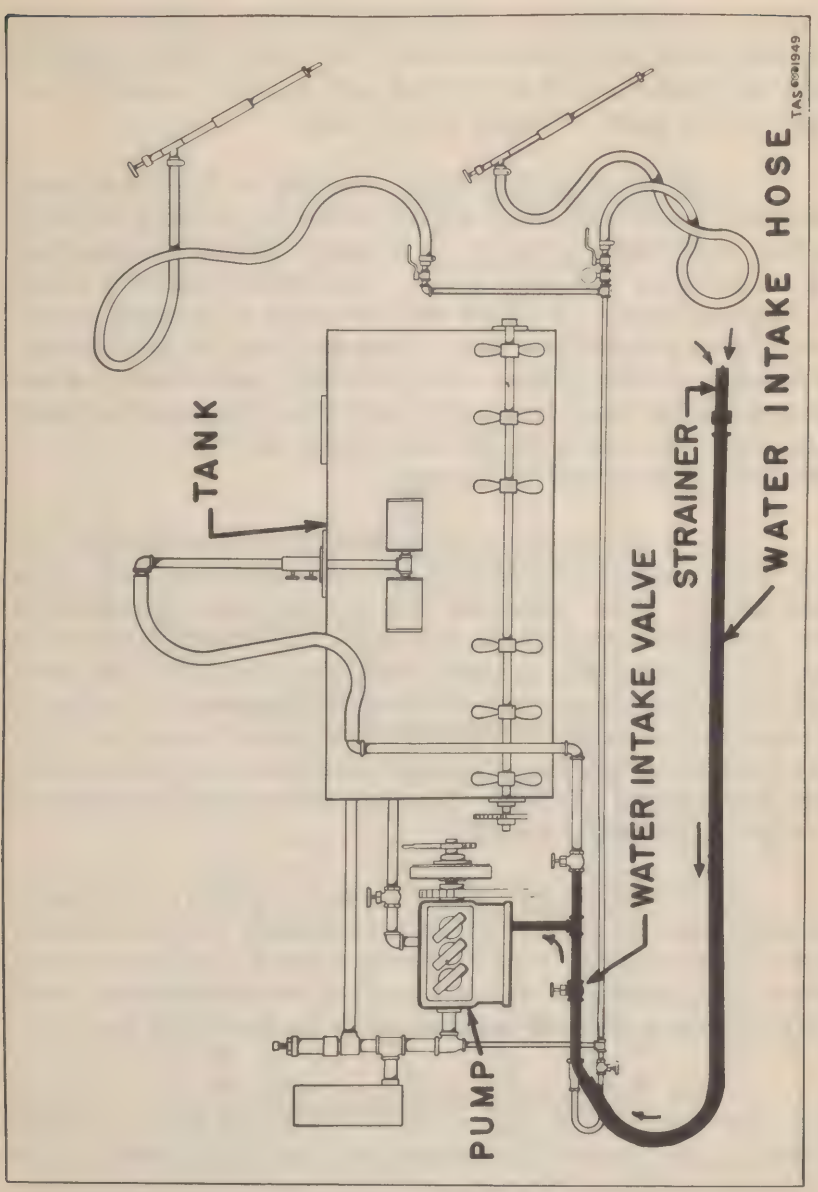

Figure 7. Water Intake Line.

streams. It consists of a flexible hose with a strainer on the free end and a water intake valve. The water intake line joins the bleach intake line at a "T", from which a third outlet is connected to the intake chamber of the pump.

(5) Injector tank filler. (See figure 8.) The injector tank filler is a device which makes possible the rapid filling of the tank with water, although all makes of the M3A1 apparatus can be filled by the pump alone. This device operates on the "venturi" principle. It is put into operation by opening the injector valve, which allows water from the pump to pass through the injector at high pressure and velocity. As a result, water is drawn into the water intake line and forced through the bleach intake line into the tank. By this means the tank can be filled with water in less than 10 minutes.

(6) Tank return line. (See figure 9.) The tank return line provides a connection from the discharge side of the pump and the tank. When the tank return valve on this line is open the liquid coming from the pump will flow freely into the tank and the pump will operate under low pressure. This valve should always be open when starting the apparatus. Otherwise it is kept closed except to relieve an air locked pump or to relieve pressure in the pump and spray hose after spraying operations are stopped. (NOTE: The tank return line is located on the rear of the "Bean" tank.)

(7) Discharge line. (See figure 10.) The discharge line leads from the discharge side of the pump to the two spray guns. It is equipped with a pressure gage, two lever cut-off valves, two lengths of spray hose, and two spray guns. Each spray gun has a shut-off valve forming the handle of the gun.

(8) Relief valve (pressure regulator) and overflow line. (See figure 11.) The relief valve is also known in some makes as the pressure regulator and unloading valve, or the pressure controller. Its purpose is to prevent excessive pres-

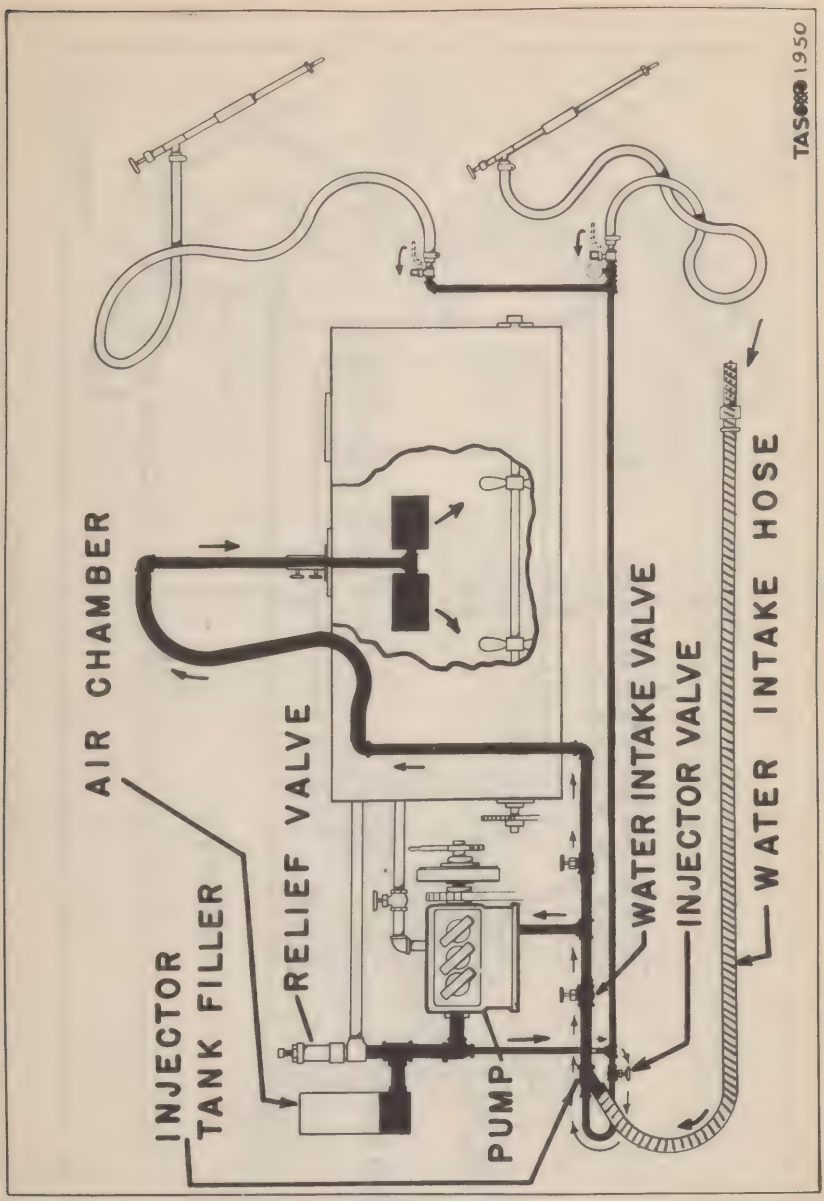

Figure 8. Injector Tank Filler.

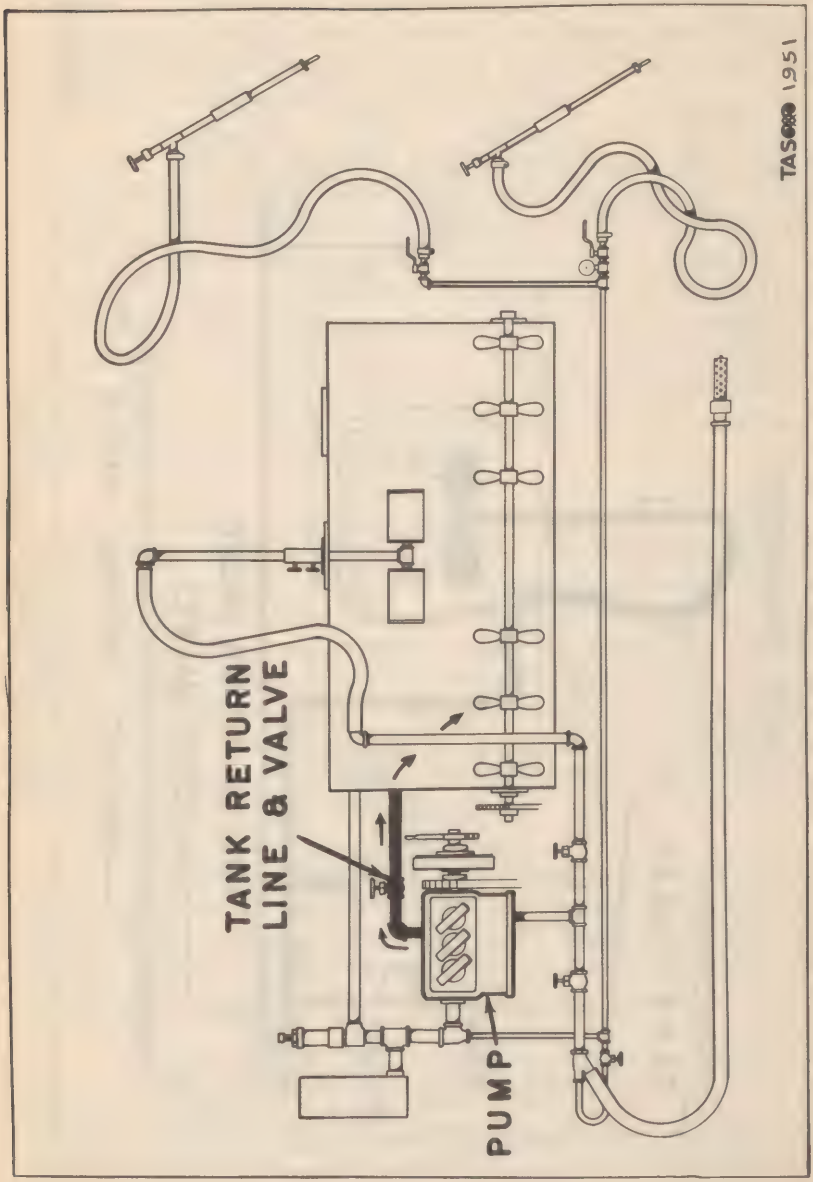

Figure 9. Tank Return Line.

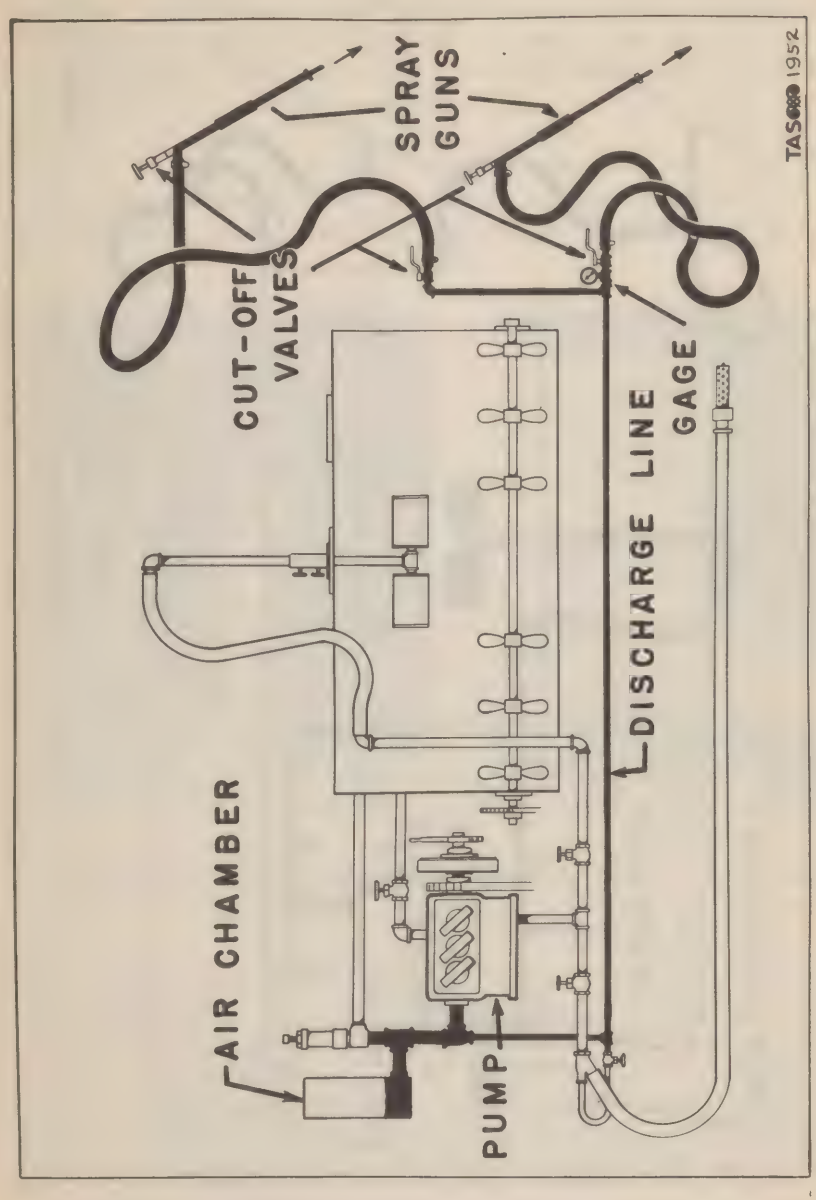

Figure 10. Discharge Line.

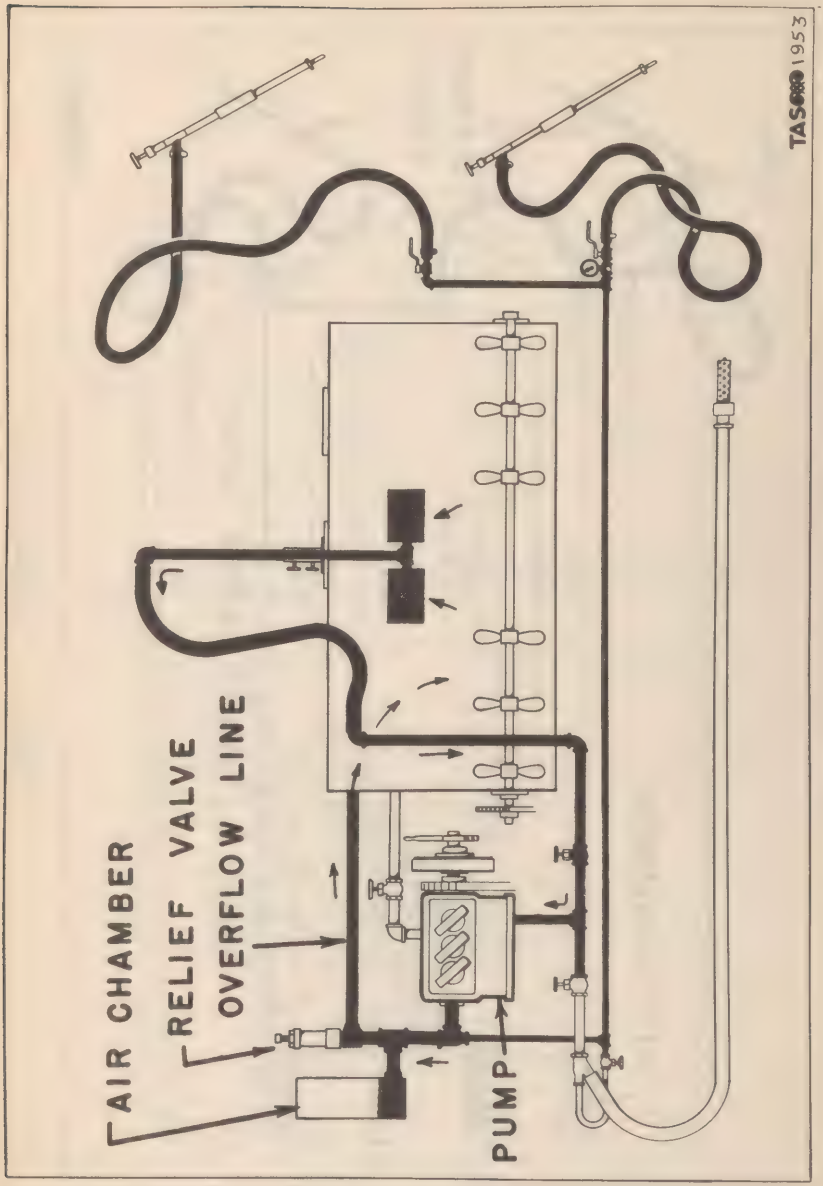

Figure 11. Relief Valve and Overflow Line.

sures. Whenever the pressure in the pump and discharge line exceeds the desired setting, the relief valve permits enough liquid to flow through the overflow line to the tank to reduce the pressure to the desired amount.

(9) Power take-off. (See figure 12.) The power take-off delivers power to the rotary agitator and pump through a driveshaft, roller chain, and clutches. The agitator is set in

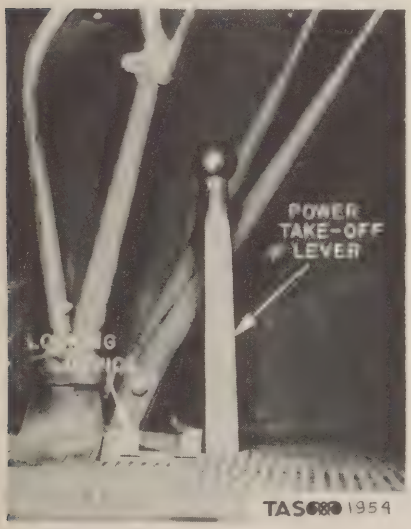

Figure 12. Power Take-Off Lever.

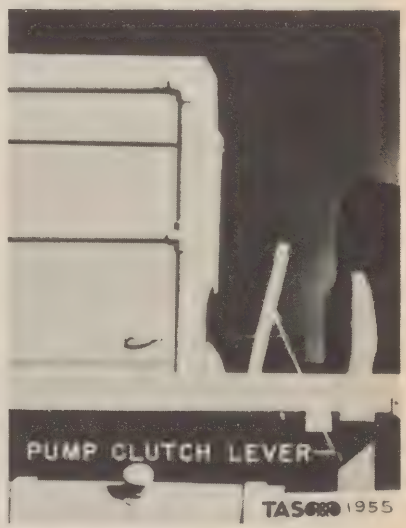

Figure 13. Typical Pump Clutch Lever.

motion by means of a power take-off lever located in the cab of the truck. This is done as follows: With the truck motor running, the truck clutch pedal is depressed with the foot, and the locking device at the foot of the power take-off lever lifted and pulled towards the rear as far as possible. The clutch pedal should then be gradually released, "feeling out" the agitator drive and ascertaining that nothing interferes with the free run-

ning of the agitator. The pump clutch lever (figure 13) controlling the pump, is mounted near the pump or at the rear of the tank. The pump is started by shoving the pump clutch lever as far as it will go. However, the lever must be engaged carefully, making certain that no obstruction interferes with the running of the pump.

(10) Pump. The pump may be operated or stopped at will with the agitator running. The agitator operates continuously as long as the power take-off is engaged. The pump must not be run dry, however, except for very short intervals, because plungers are water-lubricated and must be wet when in operation. Running with dry plungers will quickly wear the neoprene packing and also damage the porcelain cylinder walls. Before starting a pump, the crankcase must be filled with a grade of engine oil of S.A.E. 30 to 50 depending upon the temperature. The oil level called for in each individual apparatus' lubrication instructions must be maintained. In a new pump the oil should be changed after the first 60 hours of operation. Thereafter the oil should be changed after every 300 hours of operation. In some localities a large amount of water condensation may occur inside the crankcase. Water in the oil causes the oil to become gray in color. A water-oil mixture will cause the gears to heat to a dangerous degree. Should this condition occur, the oil must be drained and replaced at once. The gear case, which may be examined by removing a cover plate, will seldom need any mechanical attention; but should the need arise, specially trained personnel from chemical maintenance companies will be required to service it.

6. FILLING. a. Decontaminating materials. The M3A1 apparatus was developed for use with bleach-water mixtures. However, much persistent agent can be mechanically removed with water alone. Hot water (150° F. or hotter) may be used with good results. Water heaters are provided certain organizations. The addition of 2 pounds of soap powder and 3 pounds of washing soda per 100 gallons of water provides a good decon-

taminating material. Chemicals such as caustic soda are too corrosive to be employed in this apparatus. The most efficient and economical bleach-water mixture is prepared by mixing approximately 1 part of bleach with 1 part of water, by weight. It is accurate enough for decontamination purposes to assume that a gallon of water weighs 8 pounds.

b. Loading water. (1) If a hydrant is available, water can be loaded with a hose through the manhole in the top of the tank. (See figure 14.) In certain operations it may be desirable to haul water to the apparatus, using any tank trucks available. If a pond or stream offers the only supply, water can be loaded in about 10 minutes by utilizing the pump of the apparatus, provided the suction head does not exceed 20 feet. The closer the apparatus is to the water level the faster it will prime and fill. Complete instructions for operating each make of apparatus are furnished elsewhere in the manual. Regardless of the make of apparatus, however, its intake hose strainer must be kept free of leaves and debris. As clean water as possible must be used because grit and dirt in water at 400 pounds per square inch pressure will cause great wear on the pump parts and nozzles. Before pumping water from a stream or pond the depth of the water should be gaged with a rod or pole. If the water is less than 1/2-foot in depth the hose will be operated manually, being lowered with care to a depth midway between the water surface and the stream bed in such a manner as not to disturb the bed. An alternate method, if the water is less than 1/2-foot in depth, is to dig a hole in the stream bed approximately 1 foot by 1 foot by 1 foot, place a pail therein, and insert the intake hose in the pail. This procedure will prevent loss of time in waiting for the silt to settle.

(2) A maximum of 250 gallons of water is required for a filling, but experience indicates that 225 gallons with a proportionate amount of bleach makes a better filling since it forms a fine suspension much sooner. The quantity of water in the tank may be determined by use of a measuring stick which

Figure 14. Loading Water from Hydrant.

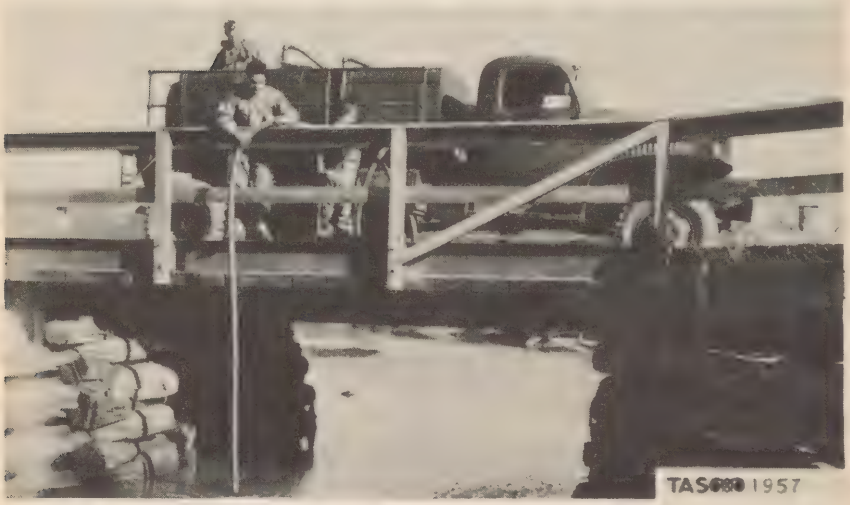

Figure 15. Loading Water from Stream.

is provided with each apparatus. (See figure 16.) The power take-off must be disengaged when performing this operation in order to prevent the measuring stick or agitator paddles from being damaged.

(3) At times it may be desirable to pump water from a stream without first filling the tank. This method may be used when washing vehicles. Specific instructions for this operation are provided elsewhere in this manual for each make of apparatus.

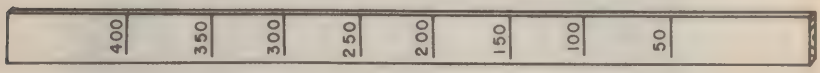

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Figure 16. Measuring Stick.

c. Loading bleach. When sufficient water is in the tank, and with the agitator running, the strainers are raised to their highest position and the desired quantity of bleach dumped through the manhole into the tank. A total of 225 gallons (estimating 8 pounds to the gallon) of water requires 1,600 pounds of bleach. The bleach frequently hardens to a mortar-like consistency and can be removed from its container only with difficulty. Usually the bleach clings tenaciously to the sides of the can, and must be loosened by beating or pounding the sides of the can. A mallet is preferred to a hammer or sledge because the indentations caused by the latter tend to prevent the contents from slipping out of the can. A hand-barrow should be used to receive the bleach as it is taken from the can. It is difficult to dislodge the bleach while standing on the operating platform of the apparatus, and repeated pounding on the bleach containers would in turn damage the wooden tank of the apparatus. Moreover, it is absolutely mandatory that bleach dumped into the tank

consist of small lumps only. Large lumps can not be entirely reduced to a suspension by the agitator and will probably clog the apparatus. As the contents of each 100-pound can of bleach are emptied into the hand-barrow they can be pounded with a mallet or with the heel of a shovel. The hopper is then placed over the manhole and the hand-barrow with its contents lifted so that the charge slides into the manhole. This operation is

Figure 17. Hand-Barrow.

repeated until the desired amount of bleach has been added. A trained crew will require approximately 30 minutes for loading a full charge. If the bleach should flow freely it may be poured directly into the tank.

d. Mixing. After the desired amounts of water and bleach have been loaded into the tank it is necessary to agitate the materials for some time to insure a uniform mixture. The

agitation time will vary from 4 minutes for a charge containing 400 pounds of bleach to over 30 minutes for a maximum charge of 1,800 pounds. A mixture of 225 gallons of water and 1,600 pounds of bleach can be thoroughly agitated in 15 minutes if large lumps are first broken up. During the mixing operation strainers should remain at the top of the tank and out of the liquid. As long as slurry remains in the tank the agitator must be in operation.

Figure 18. Loading Bleach Directly into Tank.

e. Data concerning use. (1) Unit coverage. Since no two decontamination operations will require the same amount of decontaminating agent, no definite requirements can be given. However, the following data will serve as a general guide for estimating the quantities of bleach-water mixture needed for effective coverage of several different types of surfaces.

WEIGHT OF BLEACH-WATER MIXTURE REQUIRED

FOR 1 SQUARE YARD OF TERRAIN,

MEDIUM CONTAMINATION

Kind of surface	Weight (pounds)
Concrete road (smooth)	1.0
Loose-surfaced macadam or gravel	2.0
Short grass (3 to 5 inches)	3.0
Long grass and low brush	4.0 or more

Since the bleach-water mixture weighs slightly less than 11 pounds per gallon, the approximate requirements for a given area may readily be calculated.

(2) Gasoline consumption. Allowance must be made of gasoline which will be consumed when the power take-off is in use.

7. OPERATION. a. Personnel. Experience has indicated that the power-driven decontaminating apparatus should have an operating crew consisting of one driver, one operator, and two nozzlemen. In addition to the operating crew, personnel must be provided to maintain supply dumps and transport supplies to the dump and dressing stations.

b. Operating instructions (with bleach-water mixture). (1) General. Since the specific steps in the operation of the M3A1 decontaminating apparatus will vary with the conditions with which it is to be used and with apparatus of different manufacture, the methods of operation described below will serve as a general guide only. Specific directions for the operation and maintenance of each make of apparatus will be found elsewhere in this manual.

(2) Spraying. (a) Adjusting strainers. When a

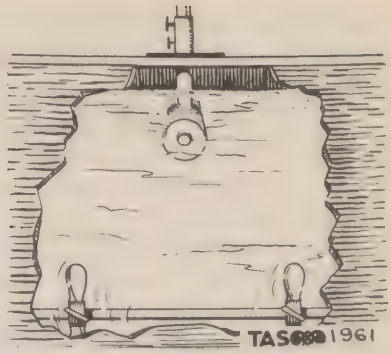


Figure 19. Strainer Position (Full Tank).

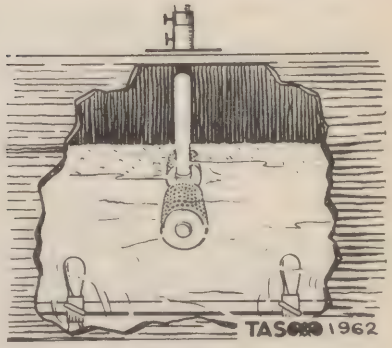


Figure 20. Strainer Position (Tank One-Half Full).

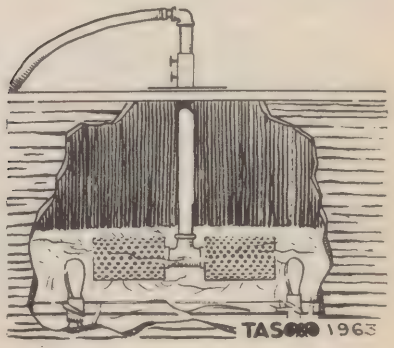


Figure 21. Strainer Position (Tank One-Quarter Full or Less).

smooth and uniform mixture of bleach and water has been obtained, the strainers are lowered to their proper position in the tank and the locking screws tightened on the riser pipe. When a full charge is used the strainers are crosswise of the tank and 12 to 18 inches below the surface of the liquid. When a charge of 225 gallons is used the strainers should be in an intermediate position and crosswise the tank (i.e., with the riser pipe fin on the top of the cover plate sleeve). With a charge of 100 gallons the strainers should be in their lowest position, lengthwise the tank. If the strainers are not placed in the positions given, clogging will definitely result. As the level of the mixture is lowered the strainers are dropped at intervals to prevent air from being drawn into the bleach intake line.

(b) Adjusting pressure. So long as the apparatus is not overloaded it will automatically maintain a pressure of approximately 400 pounds per square inch. Each make of apparatus is provided with an adjustment on the unloader or relief valve so that various pressures may be obtained if desired.

(c) Spraying. For ordinary work both spray guns are used. Two guns together should deliver about 20 gallons of bleach-water mixture per minute at a pressure of 250 to 300 pounds per square inch. When a very fine spray is desired, as for spraying vertical surfaces, one gun is used, delivering about 11 gallons per minute at not less than 375 pounds pressure per square inch.

(3) Shutting down apparatus. When spraying operations are suspended for a reason such as changing locations, the treatment of the apparatus depends upon the length of time it is shut down. However, it must be remembered that the agitator must be revolving so long as there is a bleach suspension in the tank. In general, when spraying is stopped for any time less than 10 minutes the spray gun valves are closed and the apparatus permitted to operate under pressure. If operations are suspended for a period of 10 to 30 minutes the pump clutch

lever must be disengaged. If the shut-down is for more than 30 minutes the strainers must be removed from the liquid. When operation is suspended for more than 4 hours, cleaning of the pump is necessary. IF IN FREEZING WEATHER, ALL LIQUID MUST BE DRAINED FROM BOTH TANK AND PUMP!

(4) Cleaning apparatus. To clean the M3A1 apparatus, the pump and all lines should be thoroughly flushed by pumping clean water through the pump and tank. If the apparatus is stopped for more than 48 hours, a mixture of 1 gallon of water and 1 quart of light machine oil should be run through the pump after it has been thoroughly flushed with clear water. It is advisable to wipe the exterior surface of the pump with a rag or waste saturated in oil. The purpose is to cover all metal parts with a film of oil to retard corrosion. For an indefinite stand-by condition, from 75 to 150 gallons of fresh water should be left in the tank and the openings covered.

(5) General maintenance and care of apparatus. Since bleach is highly corrosive to most metals, constant care is necessary in order to keep the apparatus in good operating condition. The instructions with respect to lubrication should be rigidly followed. In addition, valve stems, and especially the spray gun valve handles, should be oiled daily when the apparatus is in regular daily operation. Surfaces which may become accidentally coated with bleach mixture (such as the pump and power take-off when a plunger cup fails), should be brushed off, washed, cleaned, and oiled. The ball valves, seats, and gaskets, and the pump plungers, should be removed from the pump at least once each week of regular operation and thoroughly inspected for indication of possible failure. Parts that are defective or show signs of weakness should be replaced. Troubles should be anticipated and corrected, if possible, before they prevent satisfactory operation of the apparatus. It is extremely important during freezing weather to make certain that all liquid is drained from the tank and pump when the apparatus is not in use.

(a) Grease and oil are the best protection against bleach. Outside surfaces must be brushed off, washed, cleaned, and oiled where bleach has accidently been spilled. Threads on nuts, studs, drain plugs, and pipes must always be greased when the apparatus is serviced and reassembled.

(b) Bleach tends to settle and clog in small dead ends. The small pipe connecting to the pressure gage must be removed and cleaned, but the seal where the gage is attached to its base must not be broken.

(c) Plunger packing cups must be replaced immediately when the plunger leaks.

(d) The engine must not be run faster than necessary to maintain pressure.

(e) The pump clutch will heat if operated when loose and slipping.

(f) Drive chains must be adjusted for tension and alinement.

(g) Intake strainers must be kept clean.

(h) All piping must be kept tight, especially on the intake line, to prevent air leaks.

(6) Pressure drop. For efficient and economical decontamination of surfaces and areas, the apparatus should deliver a minimum quantity of bleach-water mixture at a pressure sufficiently high for satisfactory atomization of the liquid. Although a drop in pressure without a reduction in the output may occur due to wearing of the spray nozzles, a sudden pressure drop generally indicates a corresponding decrease in the output of the pump. The chief causes for reduced pressure and reduced output, together with the remedies required, may be sum-

marized as follows:

(a) Sediment may have lodged between a lower valve and its seat. The valve and valve seat must be removed and cleaned.

(b) The pipe and hose connections on the intake line may have been loosened. All loose connections must be tightened.

(c) The strainers in the tank may have clogged. They must be removed and cleaned in water. The strainers may clog on the inside as well as on the outside surfaces.

(d) The valves and valve seats may be worn and pitted. They must be replaced.

(e) The pressure regulating unloader or relief valve may be incorrectly set. The necessary adjustment must be made, following carefully the instructions contained elsewhere in this manual.

(f) Pump plunger packings may be worn too thin, and should be replaced.

(g) The intake or discharge lines and passages may be stopped with sediment. They must be washed out by circulating clean water through the pump. If this does not correct the trouble, the lines must be removed and cleaned by hand-reaming the pipes if necessary.

(h) The spray gun nozzles may have become worn and enlarged with use. This results in a gradual pressure drop without a decrease in output. New nozzles must be substituted.

(i) The pump speed may be too low. If so, the

speed must be increased by the appropriate adjustment. Care should be exercised to prevent the pump from running faster than necessary.

(7) Safety precautions. (a) Precaution against persistent agents. All persons engaged in decontamination operations should wear protective clothing and gas masks. Where danger of coming into contact with liquid vesicants is great, impermeable clothing should be worn.

(b) Precautions against bleach. A bleach-water mixture is harmful to the skin and eyes. It gives off chlorine, destroys clothing, and is somewhat destructive to shoes. A gas mask should be worn when loading bleach into the apparatus. If bleach dust or water mixture comes in contact with skin, it should be washed off immediately. Bleach is harmful not only to the skin and clothing but to vegetation.

(c) General precautions. No adjustments should be made to the pump (except when it is necessary to regulate the pressure), while the apparatus is running.

8. ECHELONS OF MAINTENANCE. a. First echelon. Duties of first echelon maintenance are performed by the operator assigned to the apparatus. They include inspection for serviceability, cleaning, lubrication, tightening, drainage, and general preservation of equipment. Reporting of required higher echelon repair is the responsibility of the operator.

b. Second echelon. Maintenance of the apparatus by the use of spare parts and tools provided with each apparatus comprises second echelon maintenance. Such maintenance is normally performed by the operating personnel, but is the responsibility of the organization commander.

c. Third echelon. Maintenance performed by Chemical Warfare Service maintenance companies is classed as third

echelon maintenance. In general, third echelon maintenance is that which requires parts not provided with the apparatus, or those field repairs that are beyond the facilities of first and second echelon maintenance. It is the responsibility of the Chemical Warfare Service through the field force commander.

d. Fourth echelon. This maintenance is performed by the Chemical Warfare Service maintenance companies, and includes major overhauling and salvage. Usually this is performed in rear areas. As with third echelon maintenance, it is the responsibility of the Chemical Warfare Service through the field force commander.

9. ADVANTAGES AND DISADVANTAGES OF POWER-DRIVEN APPARATUS. The M3A1 power-driven apparatus affords a rapid means of decontaminating surfaces such as roads which are free from tall grass or brush. It is the only convenient means of treating the exterior of a contaminated building. Its principal disadvantage is its tendency to develop mechanical trouble because of the heavy bleach-water mixture dispensed and the great length of time required for filling. One-half hour or more is spent in filling and adjusting the apparatus to every 20 minutes of spraying.

Figure 22. The "Bear" M3A1 400-Gallon Power-Driven Decontaminating Apparatus.

SECTION II

M3A1 - "BEAN"

10. DESCRIPTION. a. General. The "Bean" type apparatus, like other makes of the M3A1, has its own distinctive pump and relief-valve assembly. It can be identified by the location of its three valves just above the working platform on the right side of the pump housing (fig. 25), or by the prominent name-plate on the left side of the pump (fig. 26).

b. Pump assembly. The pump is a high pressure pump. All gears and bearings are completely enclosed and operate in a bath of oil. The valves are very accessible. Balls and seats are made of stainless steel. Plungers carry packing in the form of a special composition cup which operates in a porcelain-lined steel cylinder. The plungers may be removed for servicing.

c. Injector assembly. The injector is a device used for the speedy filling of the tank with water from a pond or stream. It does not require priming and can be used for lifting water upwards to 20 feet. (See figures 29 and 30.)

d. Relief valve. The relief valve automatically keeps the pump at the proper pressure and acts as a safety, taking care of excess pump capacity. Liquid under pressure comes from the pump to the relief valve through an opening on one

Figure 23. Rear View of the "Bean" M3A1.

Figure 24. General Arrangement of Parts.

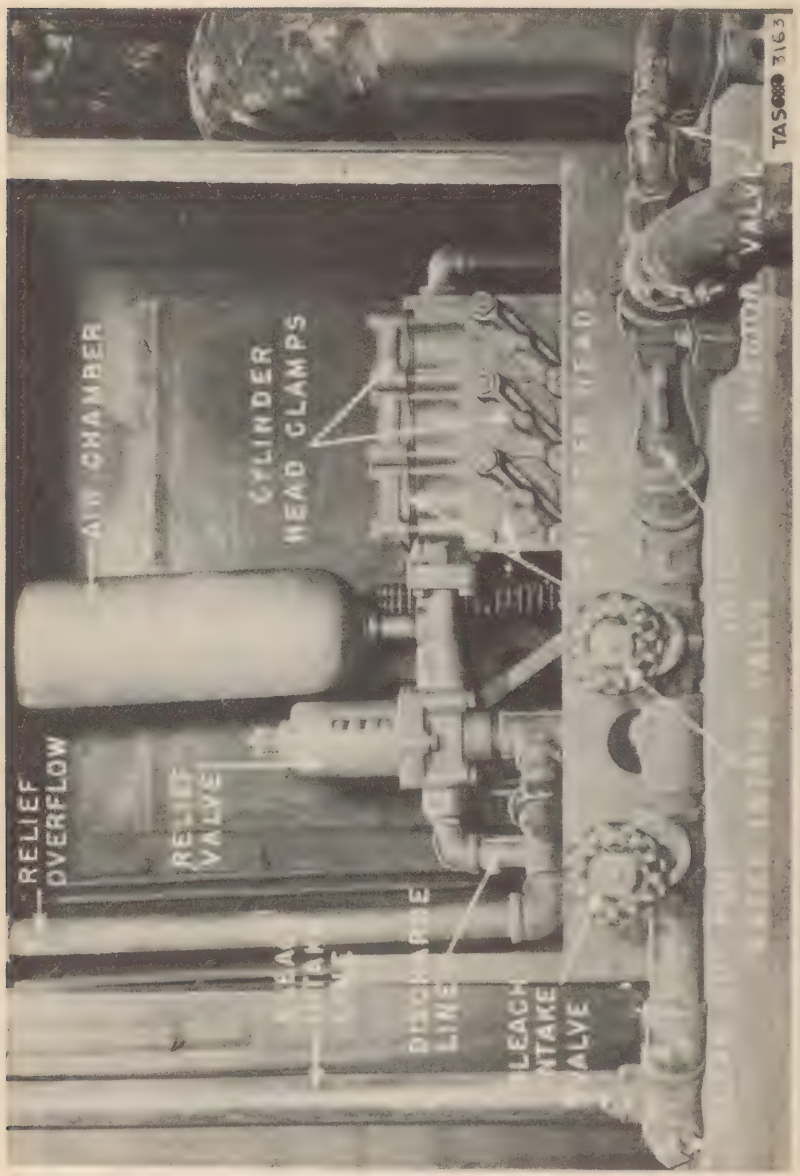


Figure 25. Right Side of Pump Assembly (Rail Removed).

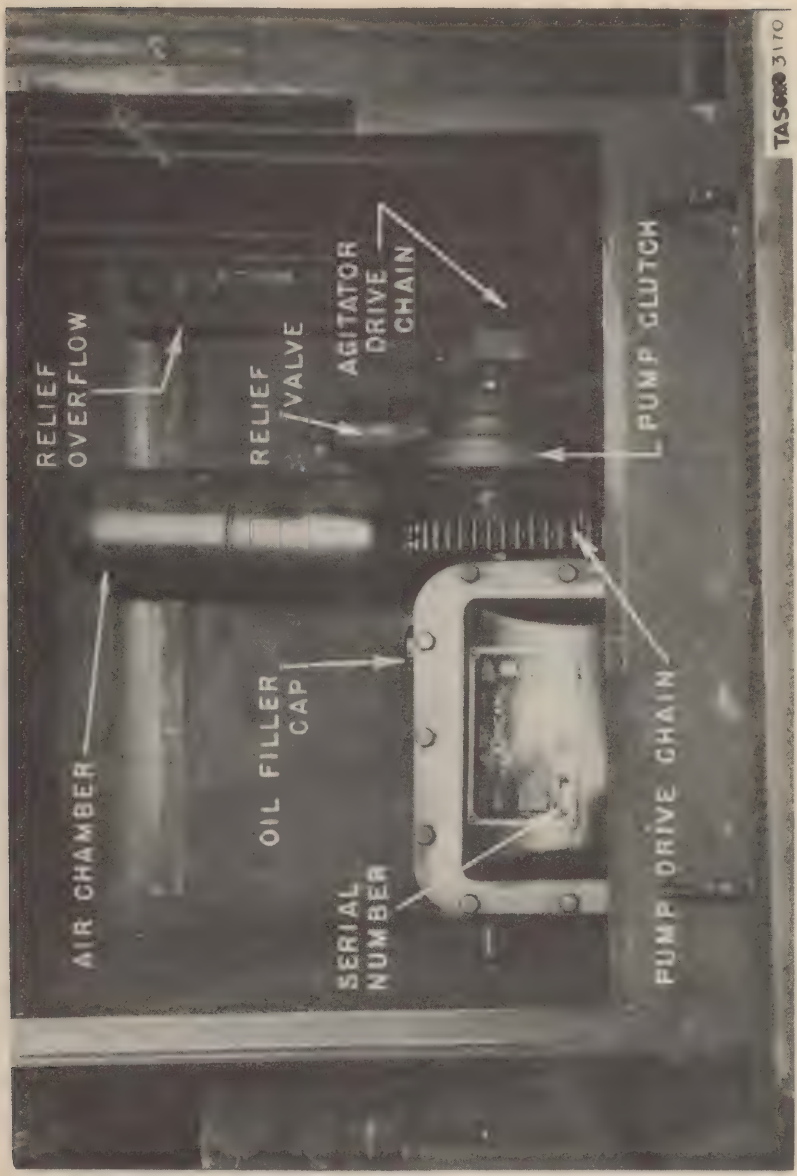


Figure 26. Left Side of Pump Assembly (Rail Removed).

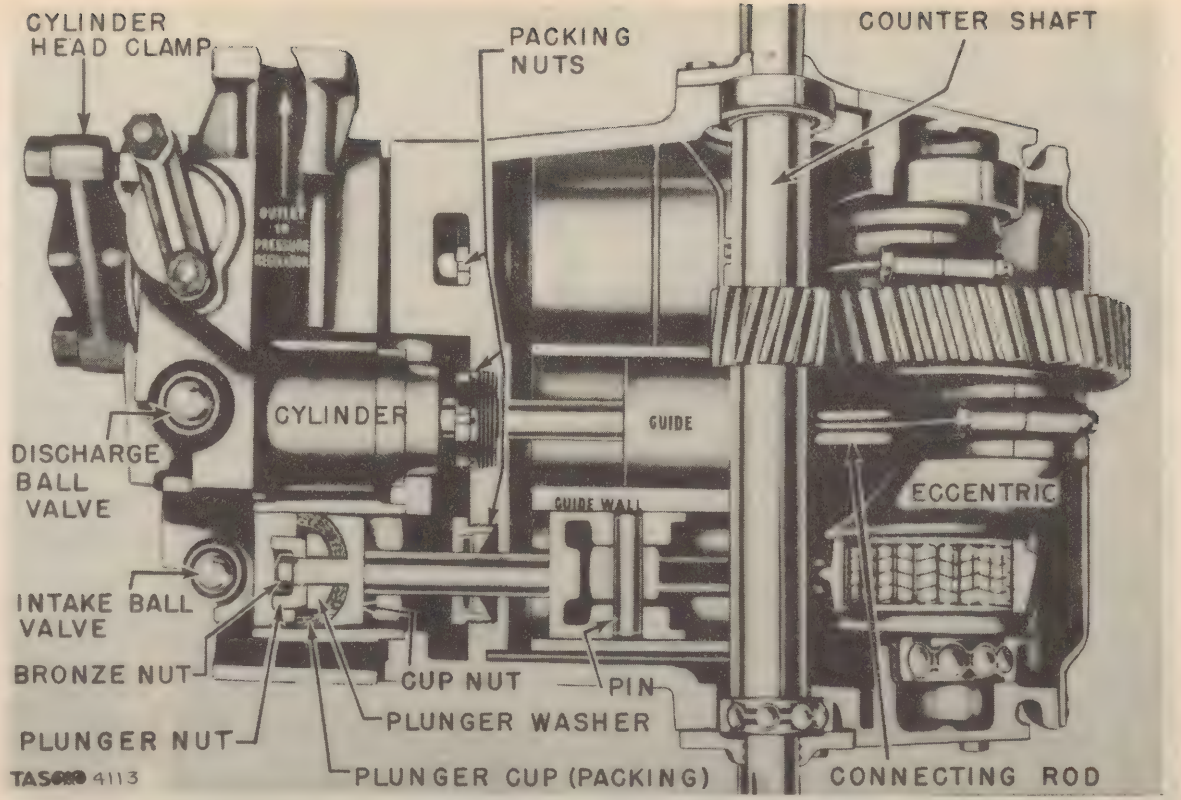


Figure 27. Top View Showing Inner Construction of Pump.

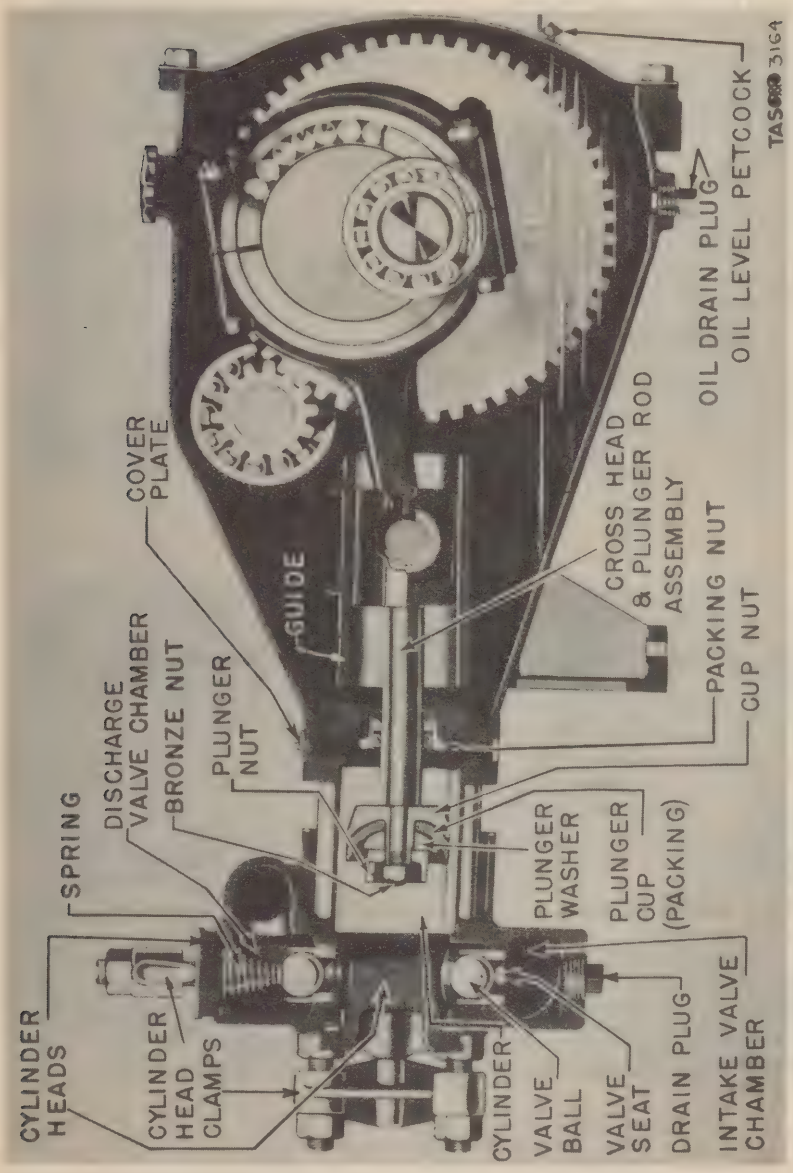


Figure 28. Side View Showing Inner Construction of Pump.

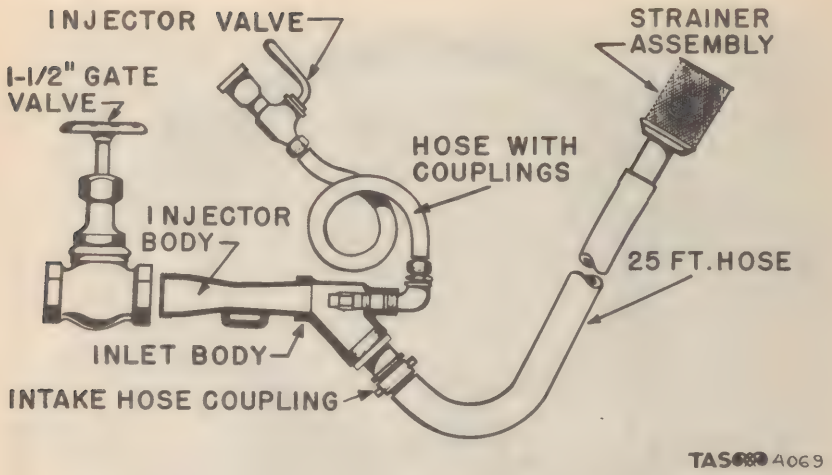


Figure 29. Injector Assembly.

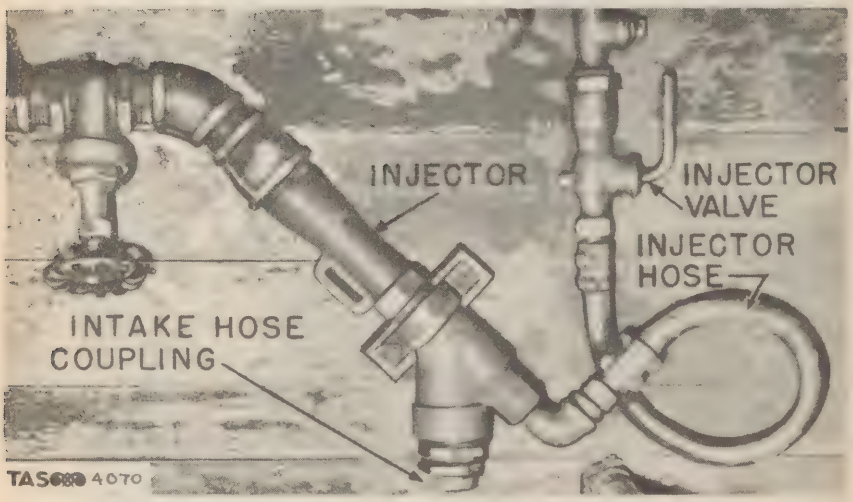


Figure 30. Injector.

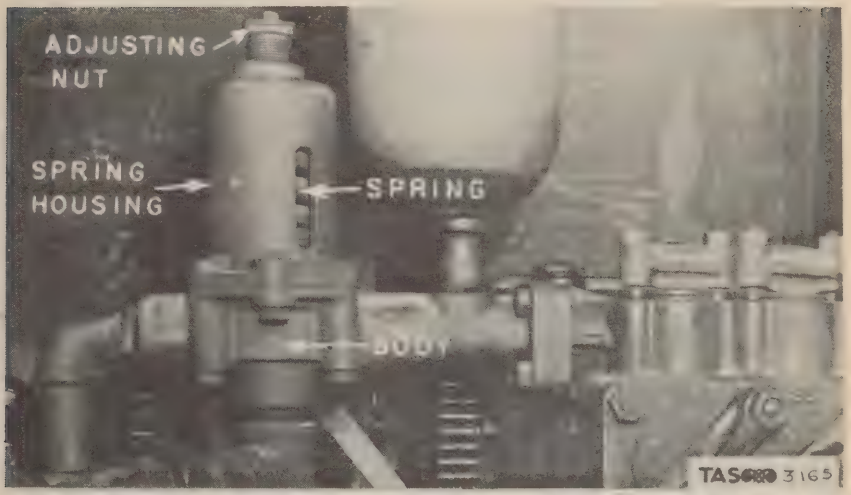


Figure 31. Relief Valve As Seen from Right Side.

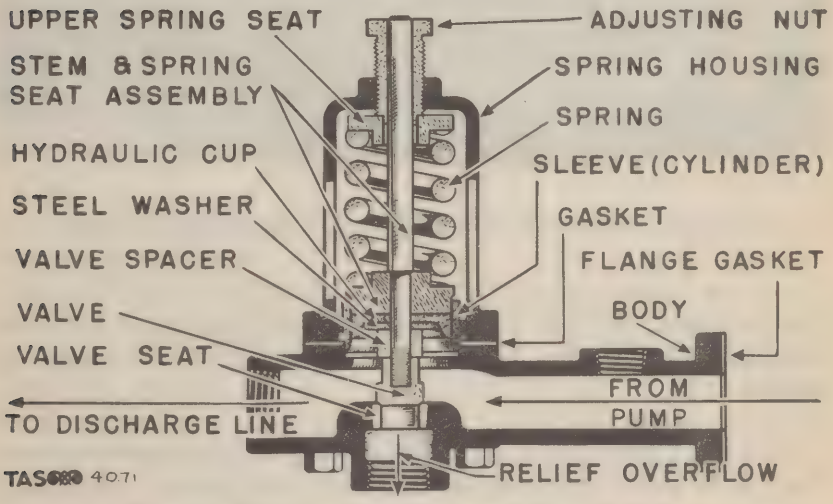


Figure 32. Sectional View of Relief Valve.

side, passing directly under an hydraulic plunger assembly and out through the other side to the discharge hose and spray guns. The spring tension controls the operating pressure (usually 400 pounds). When the pressure rises above this setting it overcomes the spring tension and forces the plunger up, which raises the valve. Raising this valve permits the excess liquid to escape through the opening in the bottom of the relief valve, through the overflow pipe and back into the tank.

Figure 33. Flow of Liquid from the Relief Valve.

e. Pump clutch. The pump clutch is a flat disk type. It is mounted near the front of the tank and operated by a lever at the rear of the tank. It is so constructed that it is easily adjusted.

f. Tank. The wooden supply tank is of 400-gallon capacity. It is held together by four metal hoop bands. Tighteners

Figure 34. Pump Clutch.

are provided for adjusting the hoop bands and are found on the bottom of the tank.

g. Agitator. The agitator is directly connected through sprockets and a roller chain to the power take-off. The agitator drive is independent of the pump drive because there are many times when the agitator must be kept running when it would be undesirable to have the pump operating. Replacement agitator paddles are provided with each apparatus.

Figure 35. Clutch Lever at Rear of Tank.

Figure 36. The Tank.

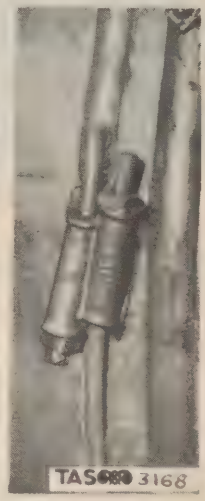


Figure 37. Hoop Band Tightener.

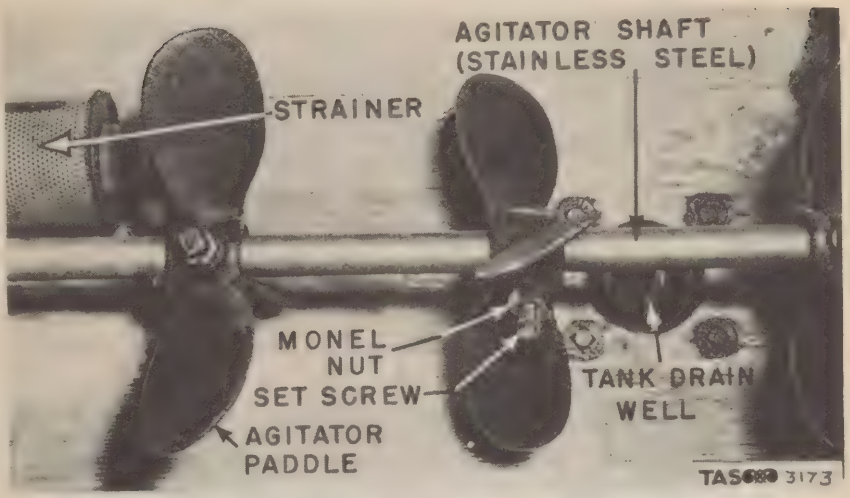


Figure 38. Partial View of Agitator Shaft and Paddles.

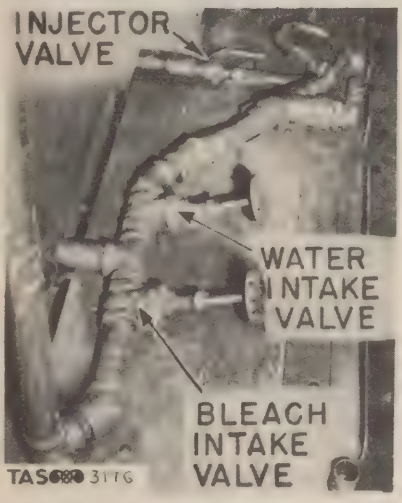


Figure 39. Valves on Side of Truck.

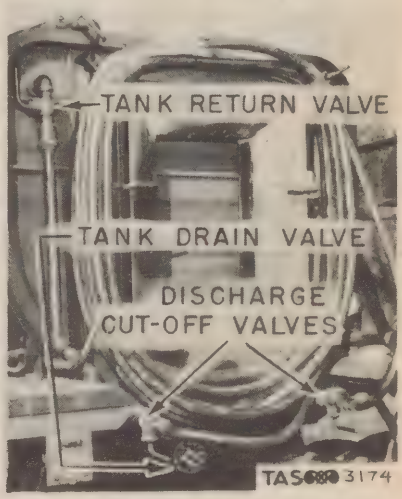


Figure 40. Valves at Rear of Truck.

h. Valves. Valves are found on the right of the pump and at the rear of the tank. They must be entirely opened or closed because a partly closed line will easily become clogged with slurry. It is also important that valves be opened and closed in the order given in the operating instructions. The water intake, bleach intake, and tank drain valves are gate valves, while the other four are of the free-ball cut-off type. The free-ball cut-off valve may require cleaning or replacement of parts (see fig. 41). Spare valves are provided with the apparatus.

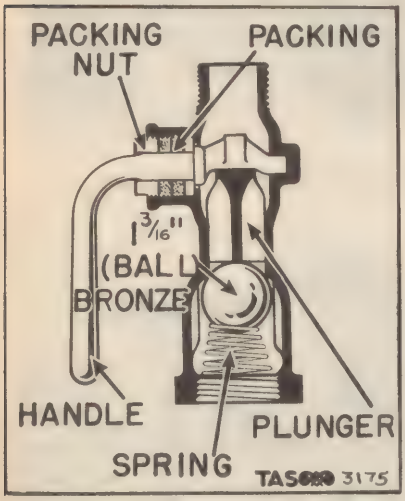


Figure 41. Parts of Free-Ball Cut-Off Valve.

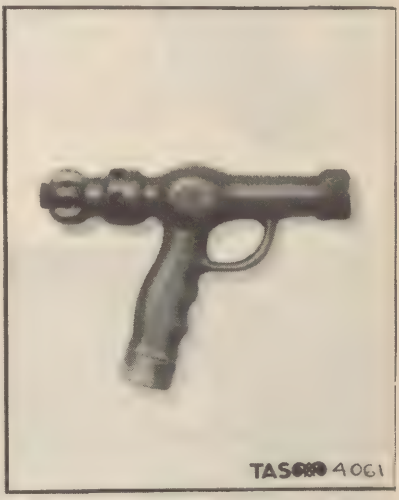


Figure 42. Washing Gun.

i. Washing gun. The washing gun is provided for cleaning, and is especially suitable for cleaning the inside of the tank.

j. Spray guns. The spray guns are of the Bordeaux type. A bamboo handle is convenient to handle, and is not affected by slurry.

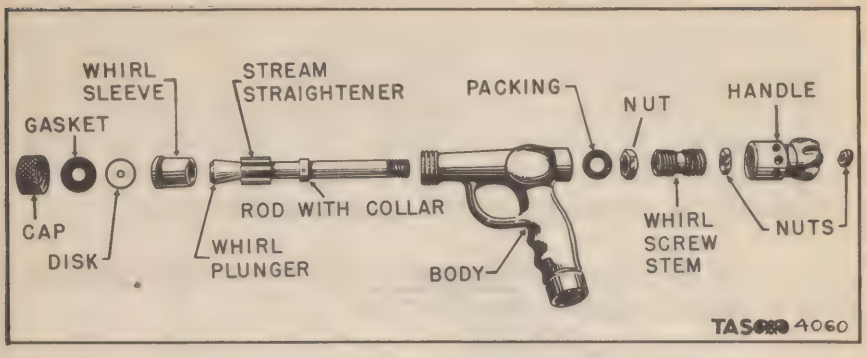


Figure 43. Exploded View of Washing Gun.

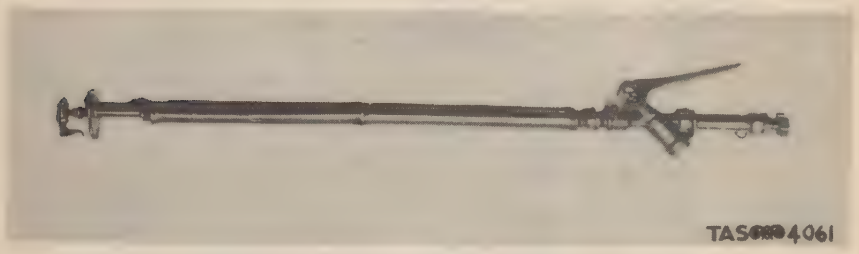


Figure 44. Spray Gun.

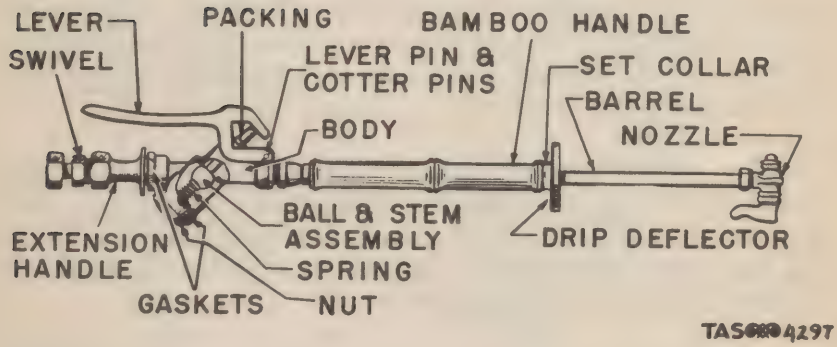


Figure 45. Parts of Spray Gun.

11. OPERATION. a. Loading water. The arrows on the diagram below (fig. 46) show the flow of water through the pipes and hose when filling the tank by means of the injector. It is not necessary to prime the pump if the plunger packing cups and valves are in good condition. The following is the correct procedure for filling the tank through the intake hose.

(1) Open the tank return valve so that the pump will not be under pressure when starting.

(2) Close the bleach intake, discharge cut-off, and injector valves.

(3) Open the water intake valve.

(4) Submerge the intake hose strainer in the water supply.

(5) Start the pump by shoving the clutch lever forward.

(6) Close the tank return valve.

(7) When the pressure "comes up" - which can be determined by reading the gage and by listening to the valves in the pump - open the injector valve, then open the bleach intake valve. (Be certain to open the injector valve before opening the bleach intake valve.)

(8) When the tank is filled, close the water intake valve and the injector valve but leave the bleach intake valve open so that the pump can draw water from the tank. Do not run the pump without water passing to keep the plungers wet, as water is the lubricating agent.

b. Loading water (alternate method). The following filling method may be employed when the tank contains enough

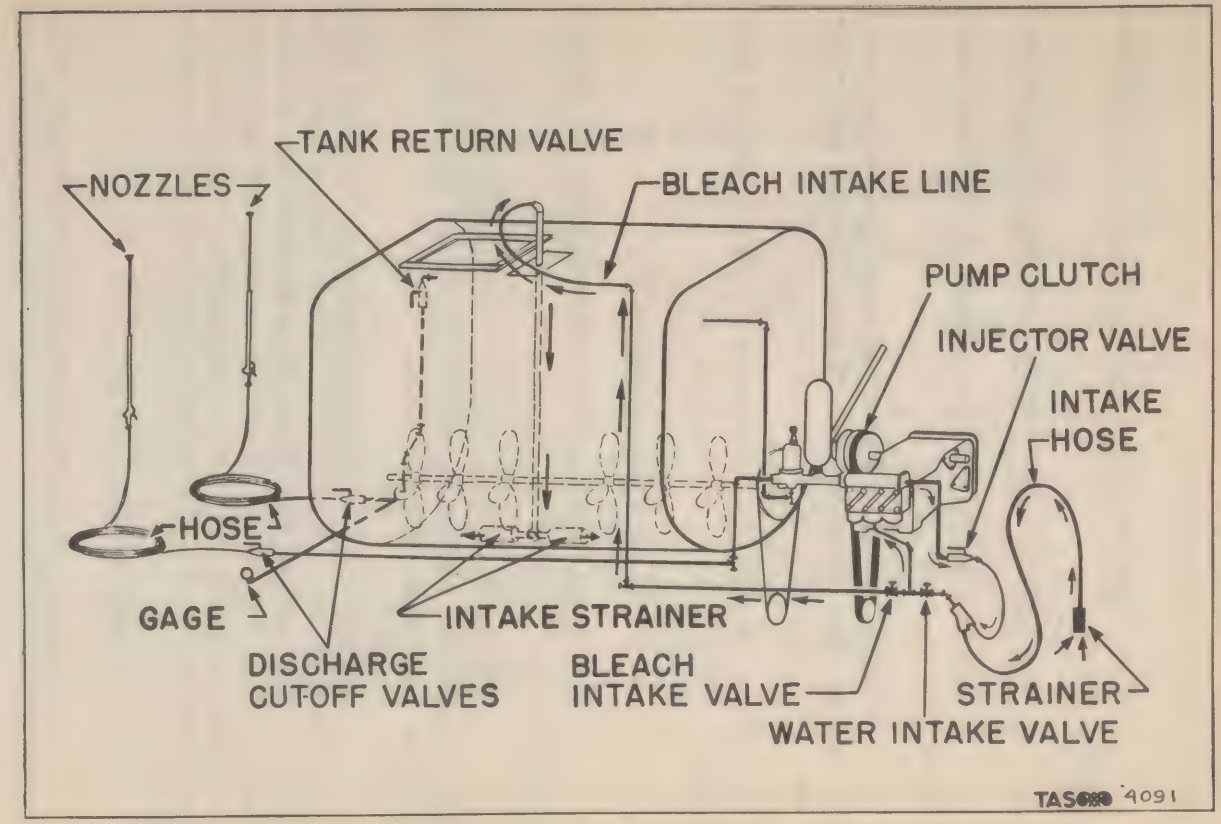


Figure 46. Arrangement of Valves and Flow of Water When Filling Tank Through the Suction Hose.

water to cover the strainers:

(1) Close the water intake, discharge cut-off, and injector valves.

(2) Open the bleach intake and tank return valves.

(3) Submerge the strainer assembly in water inside the tank.

(4) Start the pump. When water discharges at full flow into the tank from the return line, close the tank return valve.

(5) Submerge the intake hose strainer in the water supply.

(6) Open the water intake valve.

(7) When the pressure "comes up," open the injector valve.

(8) When the tank is filled, close the water intake and injector valves but leave the bleach intake valve open so that the pump can draw water from the tank.

c. Pumping water without filling tank. It may at times be desirable to pump water from a stream without first filling the tank. This may be done when washing contaminated vehicles. The same procedure is followed as for loading water until pressure "comes up," at which point the discharge cut-off valves are opened and the flow of water controlled with the spray gun valves.

d. Loading bleach. (See par. 6 c.)

e. Spraying. (Important) Start the tank agitator while the pump clutch is disengaged. Do not start the pump until after

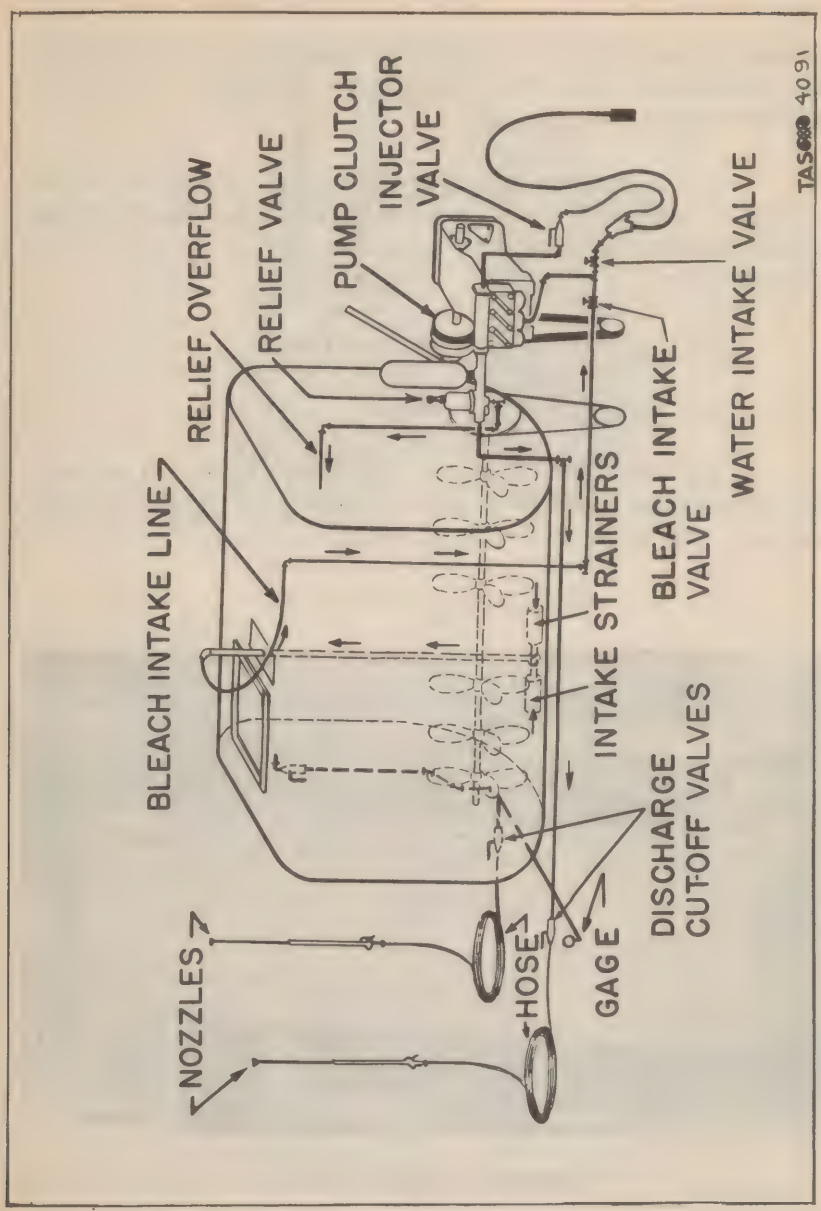


Figure 47. Arrangement of Valves and Flow of Liquid When Spraying.

the bleach suspension in the tank is thoroughly mixed. The following procedure is to be used after the bleach and water are thoroughly mixed (see fig. 47):

(1) Lower the intake strainers into the liquid in the tank. These strainers must be submerged in the liquid but not lowered to the bottom of the tank until the level of the liquid gets near the bottom.

(2) Open the bleach intake valve.

(3) Close all other valves.

(4) Start the pump by carefully engaging the pump clutch. When the pressure "comes up," open the discharge cut-off valves. The apparatus is then ready to spray.

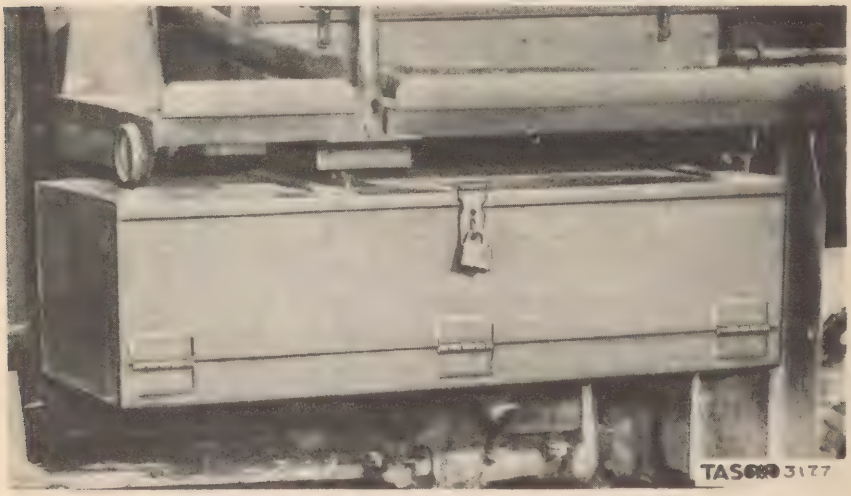


Figure 48. Repair Kit.

Figure 49. Brooms, Brush, and Shovels in Repair Kit.

12. TOOLS AND SPARE PARTS. a. Repair kit. The repair kit is mounted on the left side of the truck and contains shovels, brooms, grease, oil, a scrub brush, and a tool box.

b. Tool box. Tools and certain smaller replacement parts are kept in the tool box. (See figs. 50, 51, 52, 53, 54 and 55.)

(1) Tools in tool box.

(2) Spare parts in tool box.

c. Spare equipment chest. Other spare parts are kept in the spare equipment chest. (See figs. 56, 57, 58, 59 and 60.)

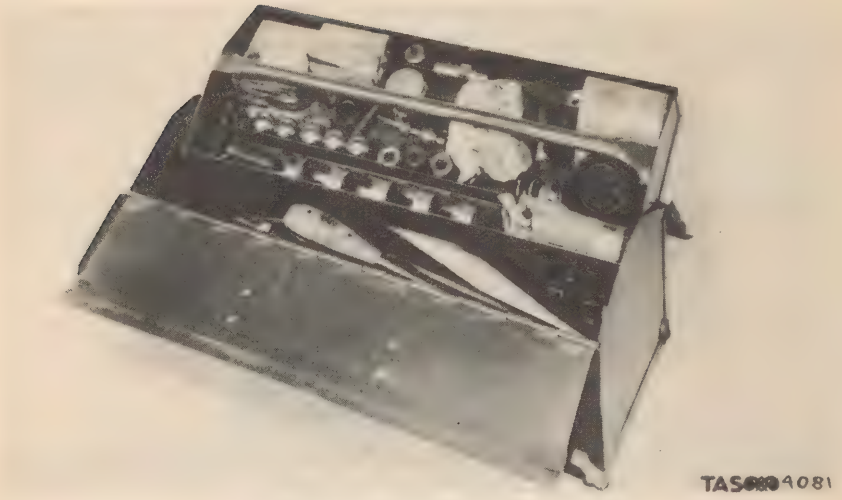


Figure 50. Tool Box.

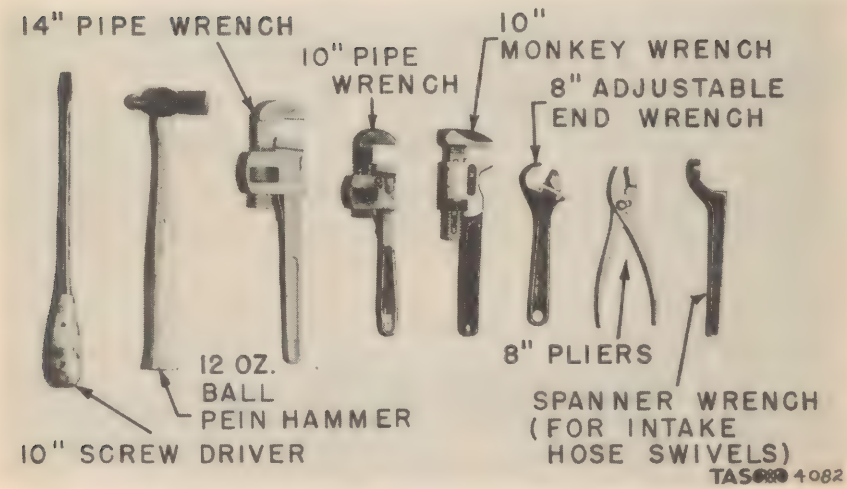


Figure 51. Common Tools in Tool Box.

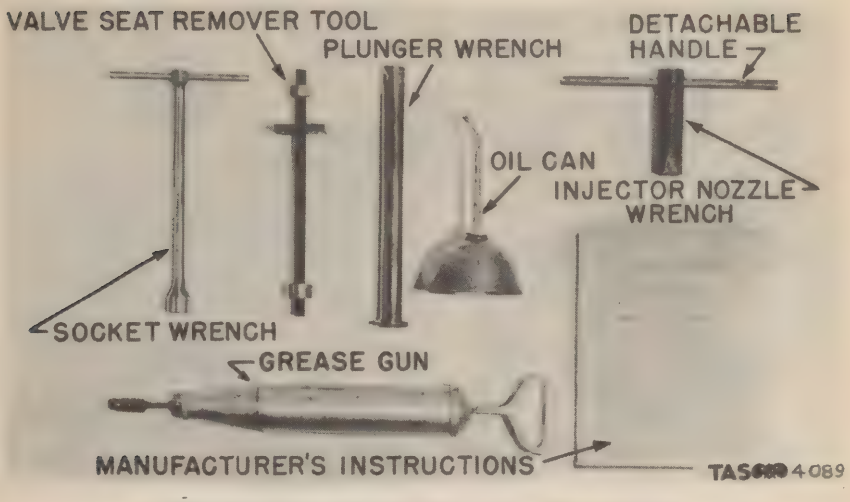


Figure 52. Other Tools in Tool Box.

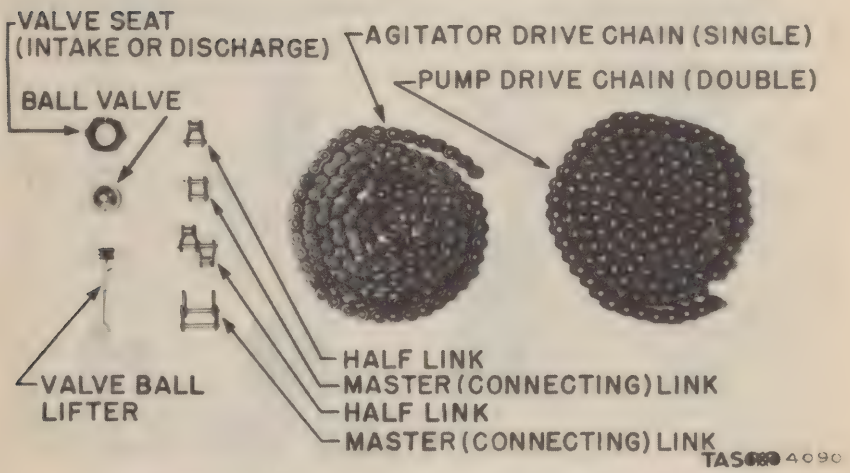


Figure 53. Spare Parts in Tool Box (1).

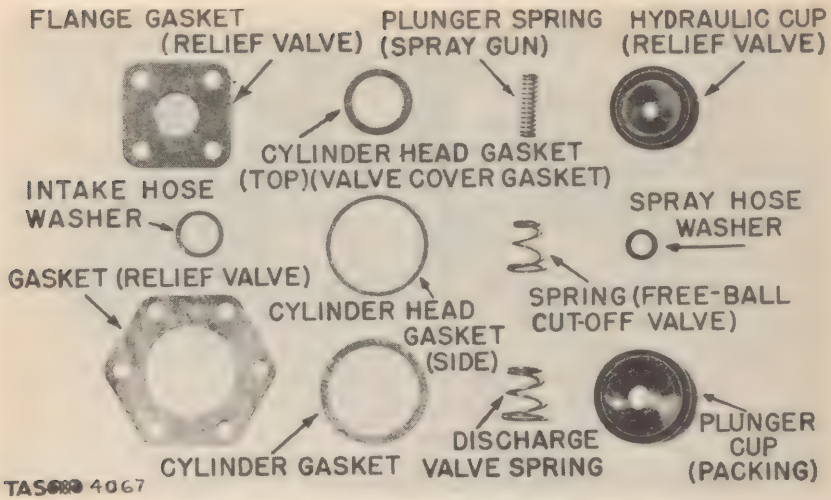


Figure 54. Spare Parts in Tool Box (2).

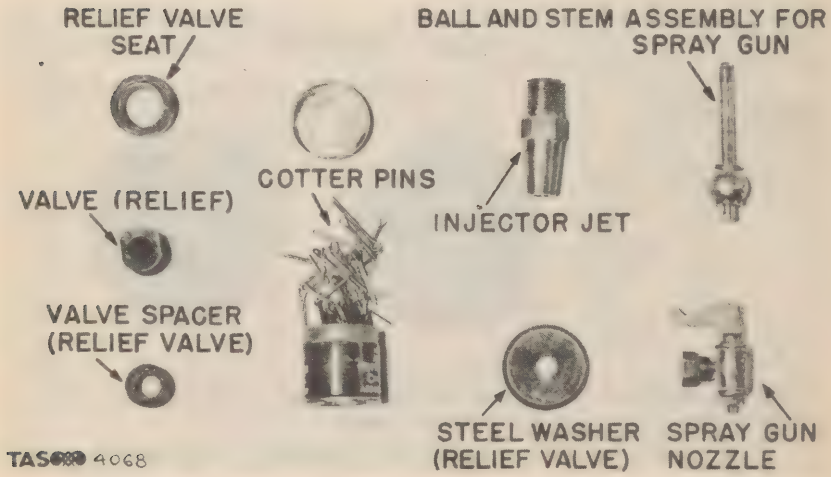
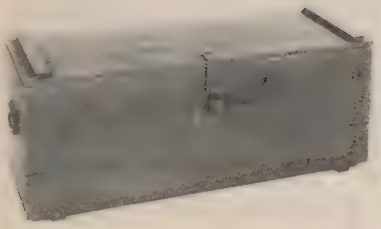
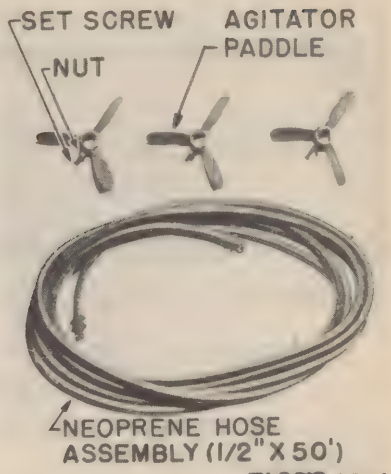


Figure 55. Spare Parts in Tool Box (3).



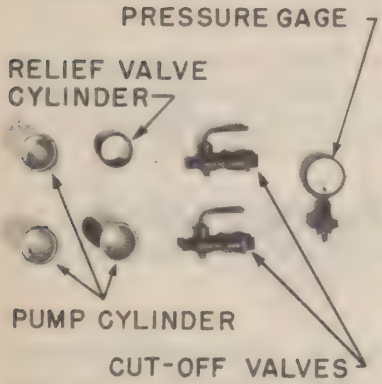
TASCO 4075

Figure 56. Spare Equipment Chest.



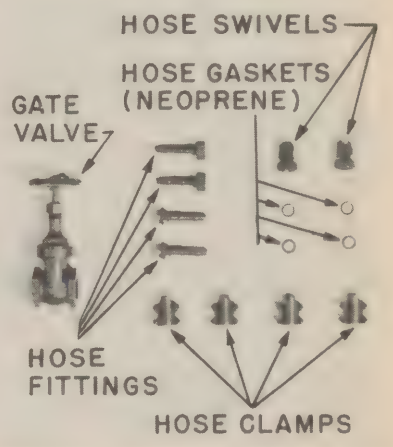
TASCO 4076

Figure 57. Contents of Spare Equipment Chest (1).



TASCO 4077

Figure 58. Contents of Spare Equipment Chest (2).



TASCO 4078

Figure 59. Contents of Spare Equipment Chest (3).

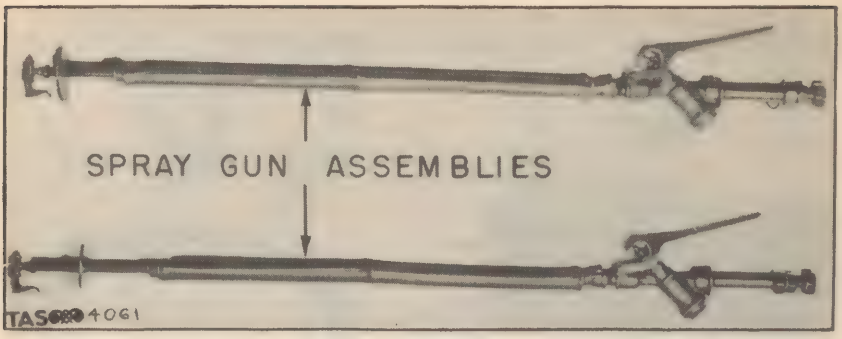


Figure 60. Contents of Spare Equipment Chest (4).

13. SIMPLE MAINTENANCE. a. Lubrication. Lubrication points are shown in figure 61. The following instructions must be carefully observed:

(1) Use high grade S.A.E. No. 30 motor oil. Keep filled to level of petcock (approximately 5 quarts required). Drain and renew oil at end of each 100 hours of pump operation. When draining, remove inspection plate and wipe out bottom of crankcase to clean out any sediment which may have collected.

(2) Grease agitator twice daily; use either calcium base grease or water pump grease. These grease cups should be turned up a little each time after use to force bleach out of agitator bearings.

(3) Apply motor oil to roller chains twice daily. Do not use grease. When chains get dirty, remove and wash in gasoline, then oil thoroughly before replacing.

(4) Main drive chain tightener. Disassemble and use wheel bearing grease once per year. (See figure 62.) The main drive chain idler is provided with sealed ball bearings. To lubricate: Remove the sprocket and bolt assembly from the machine, take out the bolt, then drive one bushing out of the ball bearings and pack with wheel bearing grease. (The bushing

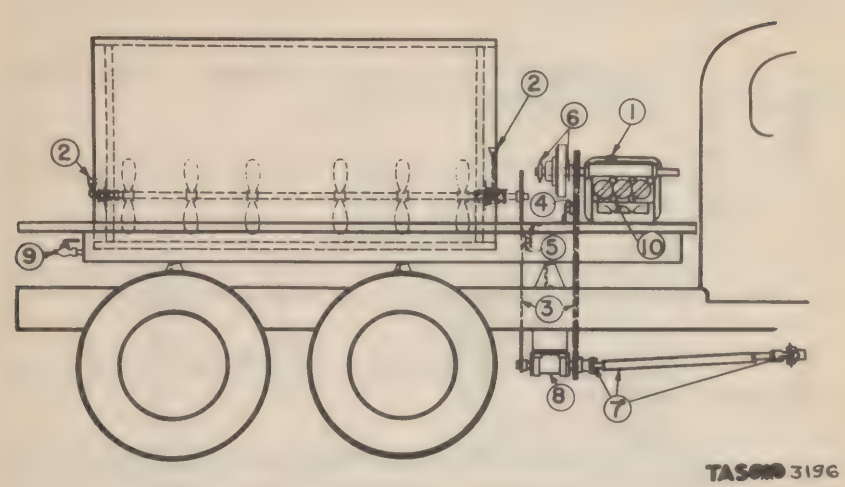


Figure 61. Lubrication Points.

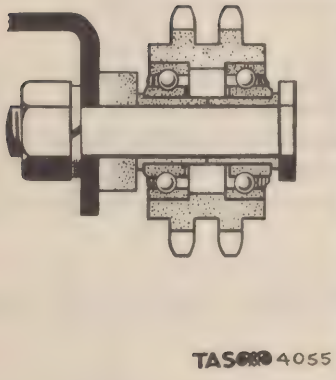


Figure 62. Main Drive Chain Idler.

Figure 63. Agitator Chain Idler.

should come out easily.)

(5) Agitator drive chain tightener. One turn on grease cup twice daily. (See figure 63.)

(6) Pump clutch. Apply small amount of grease twice daily (2 fittings).

(7) Universals. Use S.A.E. No. 140 gear oil. Apply occasionally, when lubricating chassis (3 fittings).

(8) Jackshaft. Has grease-packed ball bearings and requires no attention.

(9) Disassemble all shut-offs daily and apply grease to inside parts to help protect against action of bleach material.

(10) Always grease threads on studs when reassembling. Grease helps protect against corrosive action of bleach material.

(11) Relief valve (not shown in figure 61). Oil plunger and spring, twice daily.

b. Drainage. (See fig. 64.) All water must be drained from the pump, relief valve, pipes, tank, and hose whenever there is any likelihood of the temperature falling below the freezing point. A temperature only a few degrees below freezing will crack the block of an undrained pump. The apparatus should be drained as follows:

(1) Open the bleach intake valve and the tank drain valves.

(2) Let the pump run, pumping air only long enough to force water out of the pump. (Not over 10 seconds) This operation usually expels most of the water but can not be relied upon.

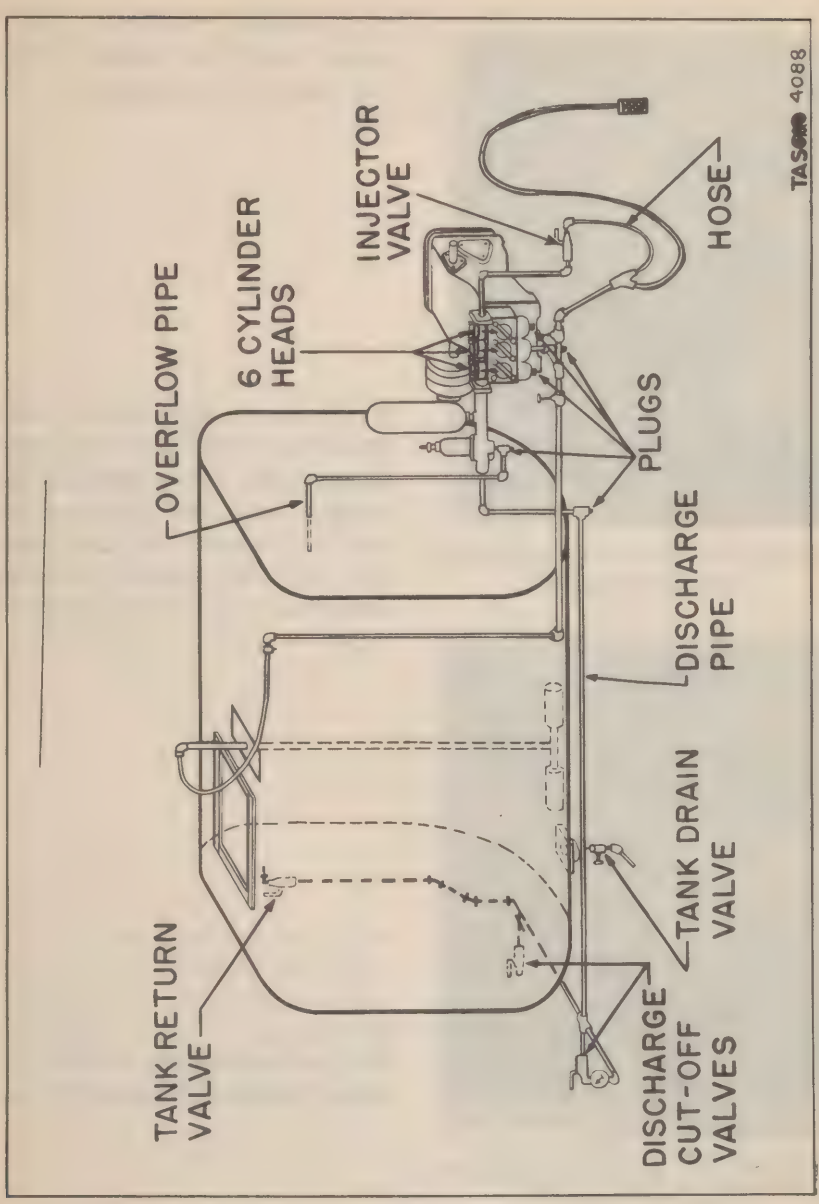


Figure 64. Drainage Points.

Figure 65. Removal of Pump Drain Plugs.

(3) Remove the two drain plugs from the bottom of the left and right cylinders. (Fig. 65)

(4) Remove the drain plug from the bottom of the pump intake line. This plug is located about one foot below the middle cylinder of the pump and may be seen by looking over the top of the gasoline tank.

Figure 66. Removal of Side Cylinder Heads.

(5) Remove the three side cylinder heads. (Fig. 66)

(6) Loosen the top cylinder heads. (Fig. 67)

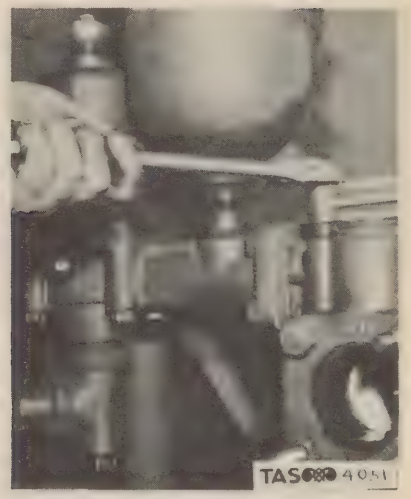


Figure 67. Loosening Top Cylinder Heads.

(7) Lift the three upper valve balls by inserting a finger through the side cylinder head openings. This will release any liquid trapped above the outlet valve balls. (Fig. 68)

Figure 68. Lifting Upper Balls with Finger.

Figure 69. Lifting Balls on Lower Left and Right with Finger.

(8) Lift the left and right valve balls of the intake valve by inserting a finger through the drains in the bottom of the pump. (Fig. 69)

Figure 70. Lifting Lower Center Ball with Ball-Lifter.

(9) Lift the middle intake valve ball (lower center) by inserting the moistened vacuum cup ball-lifter through the center side cylinder head. (Fig. 70)

(10) Remove the drain plug at the bottom of the relief valve. (Fig. 71)

Figure 71. Removing Drain Plug from Relief Valve.

(11) Remove the drain plug from the discharge pipe. (This plug is near and below the front end of the spray tank and is reached by crawling under the truck. (Fig. 72)

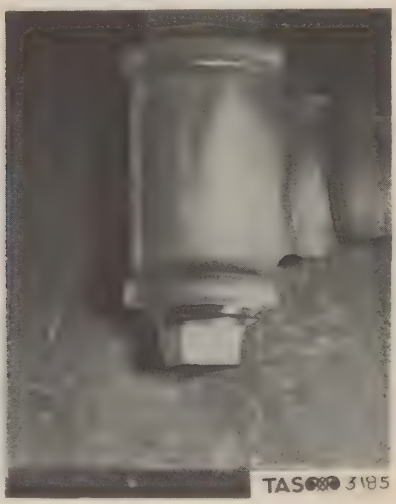


Figure 72. Discharge Pipe Drain Plug.

(12) Open the tank return valve located on the upper rear left side of the tank. (Fig. 40)

(13) Open the two discharge cut-off valves located at the lower rear of the tank. (Fig. 40)

(14) Drain the two spray hose and guns by uncoiling the hose and opening the spray gun valves.

(15) Open the injector valve. (This valve is the one nearest the cab on the right side of the truck. Fig. 73.)

(16) Disconnect the short hose from the injector.

(17) Check and tightly replace all drain plugs and cylinder heads.

Figure 73. Injector Valve and Hose.

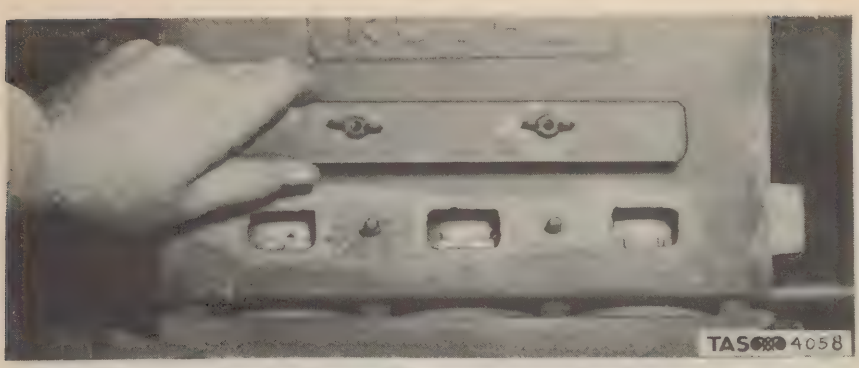


Figure 74. Loosening Wing Nuts and Removing Cover Plate.

14. ADJUSTMENTS. a. Piston plunger rod packing. Each packing nut should be tightened a little about every 100 hours of operation. To tighten, remove the cover above the nuts, (fig. 74) insert a screwdriver in the notches provided in the nuts, and by prying, turn to right. (Fig. 75) When turned clear in, it will be necessary to disassemble the pump and install new packing rings - a third echelon task.

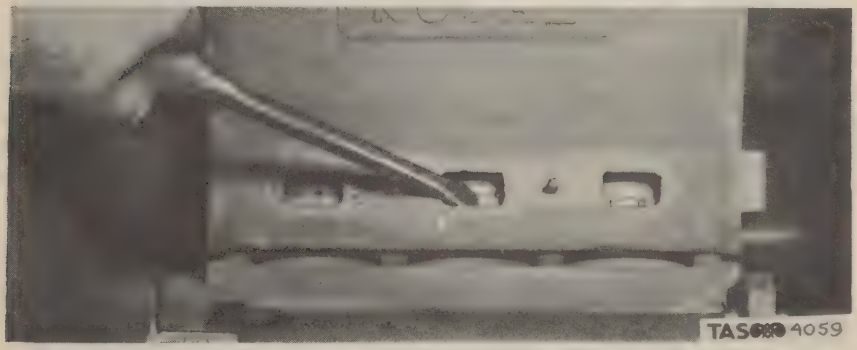


Figure 75. To Tighten - Insert Screwdriver in Notches and Turn to Right.

b. Agitator shaft packing. The packing nut on the end of the agitator shaft must be kept tight enough to prevent play and leakage. (Fig. 76)

Figure 76. Tightening Packing Nut.

Figure 77. Adjusting Regulating Nut.

c. Relief valve. To increase the operating pressure, tighten the adjusting nut. To decrease the operating pressure, loosen the adjusting nut. (Fig. 77)

d. Pump clutch. The clutch must not slip, or heating and rapid wear will take place. To tighten, shove the clutch handle forward until the clutch is half-way engaged. Pull out the lock pin, insert a nail or wire to hold it in place, and turn the collar clockwise. (Fig. 78) The collar is best turned with a sharp instrument inserted in one of the holes in the clutch collar. (Fig. 79)

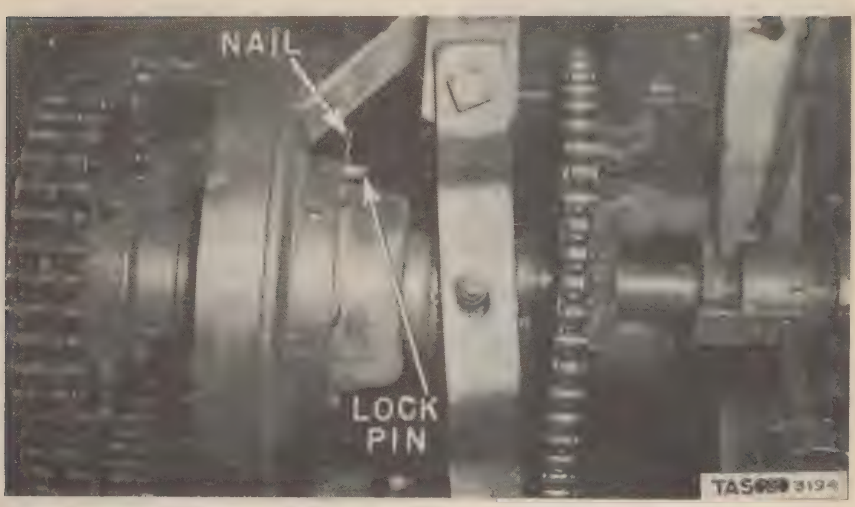


Figure 78. Pump Clutch with Lock Pin Pulled Out and Held in Place with Nail.

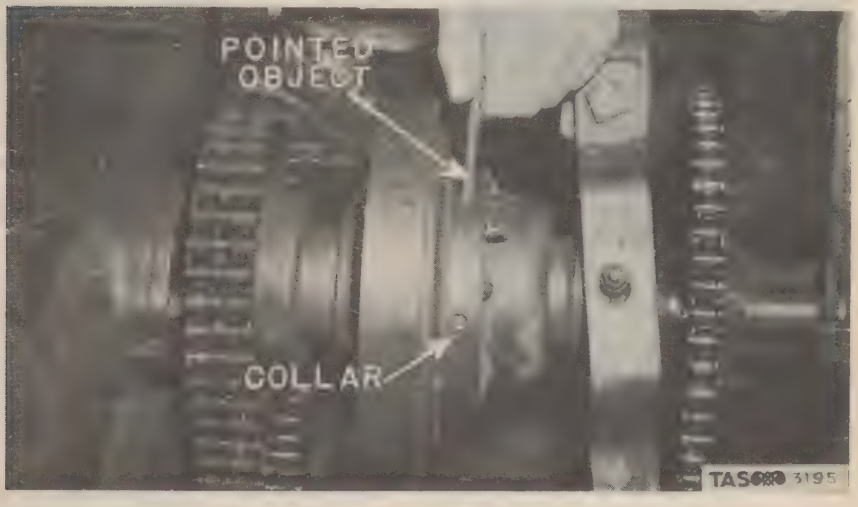


Figure 79. Adjusting the Pump Clutch.

Figure 80. Pump Chain Tightener (Idler).

e. Chain tightener. (Fig. 80) Too tight a chain causes rapid wear. Too loose a chain will climb the sprockets. Keep the chain adjusted at 1/2-inch to 1-inch slack, as illustrated. (Fig. 82) The chains are tightened by loosening the idler sprocket, (fig. 81) moving it forward, and tightening. Sprockets must be kept in proper alinement. Check with a straight edge if teeth show signs of wear on one side.

Figure 81. Agitator Chain Tightener (Idler).

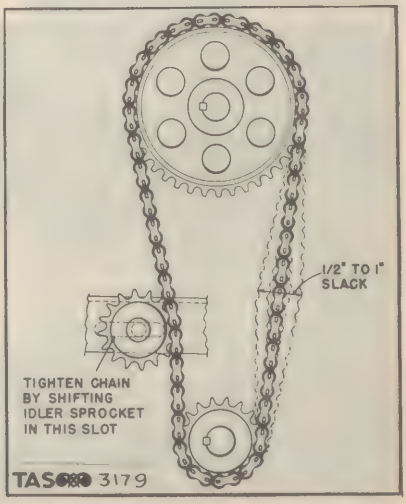


Figure 82. View of Chain Assembly.

15. REMOVAL AND REPLACEMENT OF PARTS. a. Plunger assembly. It is frequently necessary to remove the plunger assembly for cleaning or replacement of packing. This operation is performed as follows:

Figure 83. Pump with Side Cylinder Heads Removed.

(1) Remove the side cylinder heads. (Fig. 83)

Figure 84. Removing Nut from Plunger.

(2) Remove the bronze hexagonal nut on the end of the plunger rod, using the special socket wrench. (Fig. 84)

(3) Remove the plunger packing (cup) assembly with the plunger wrench by twisting it to the right and then withdrawing it. (Fig. 85)

(4) Disassemble the plunger packing (cup) assembly. (Figs. 86, 87, 88, 89)

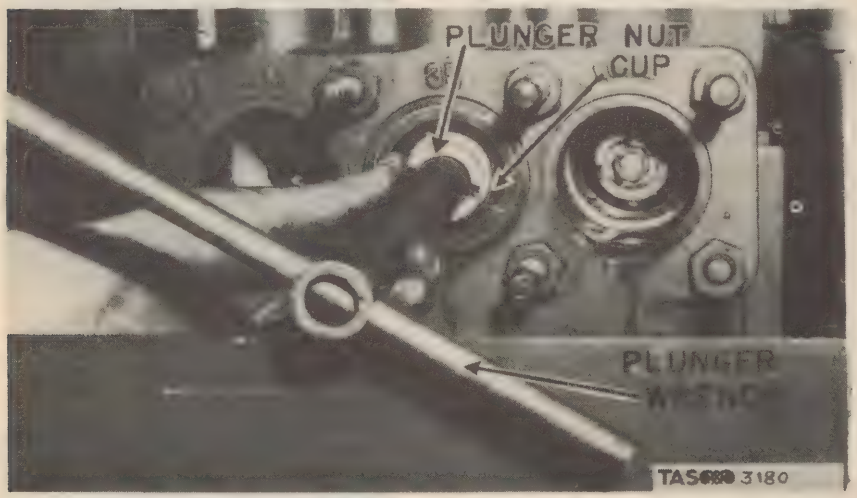


Figure 85. Removal of Plunger Packing (Cup).

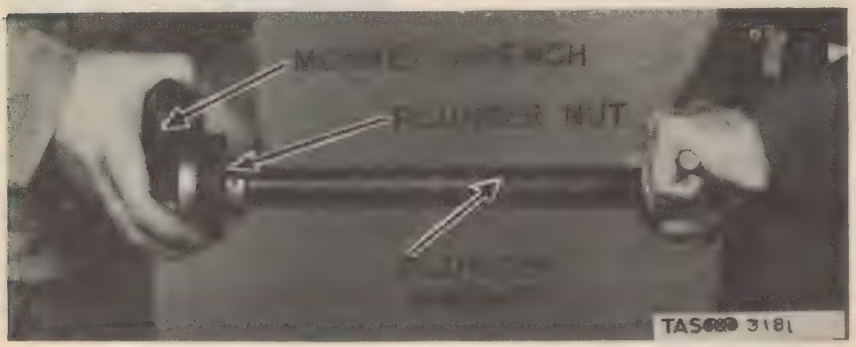


Figure 86. Disassembly of Plunger Packing (Cup) Assembly (1).

Figure 87. Disassembly of Plunger Packing (Cup) Assembly (2).

Figure 88. Disassembly of Plunger Packing (Cup) Assembly (3).

Figure 89. Disassembly of Plunger Packing (Cup) Assembly (4).

Figure 90. Lubricating New Cup with "Castor Dag."

(5) Clean the porcelain cylinder walls, taking care not to damage the porcelain. Clean off the accumulated hard deposit of bleach at each end of the plunger stroke in the cylinder. A new packing (cup) would suffer severe damage when rubbing against such a deposit.

(6) Carefully clean and oil the cup nut.

(7) Install new plunger packing (cup) and assemble reasonably tight. It is not necessary or desirable to assemble too tightly.

(8) The new packing is stiff; therefore a small amount of "castor dag," or light oil or grease, should be placed on the edge of the packing to make it easier to force into the cylinder. (Fig. 90)

(9) Put plunger assembly back into the cylinder, using the plunger wrench, pushing forward, and twisting to the right.

(10) Replace the bronze hexagonal nut.

(11) Replace the cylinder head, clamp, and nuts.

b. Valve assembly. From time to time it is necessary to remove the valve balls and seats for replacement of worn parts or for cleaning. This operation is performed as follows:

(1) Remove both side and top cylinder heads. (Fig. 91)

Figure 91. Removing Side and Top Cylinder Heads

(2) Remove balls with special tool. (Fig. 92)

Figure 92. Removing Valve Balls

Figure 93. Attaching Nut to Bottom of Valve Seat Remover

(3) Insert shaft of valve seat remover and attach the lower nut just below the valve seat to be lifted. (Fig. 93)

Figure 94. Loosening the Lower Valve Seat

(4) Loosen the valve by tightening the upper nut on the valve seat remover. (Fig. 94)

(5) Lift the valve seat remover and seat. (Fig. 95)

Figure 95. Lifting Tool and Seat

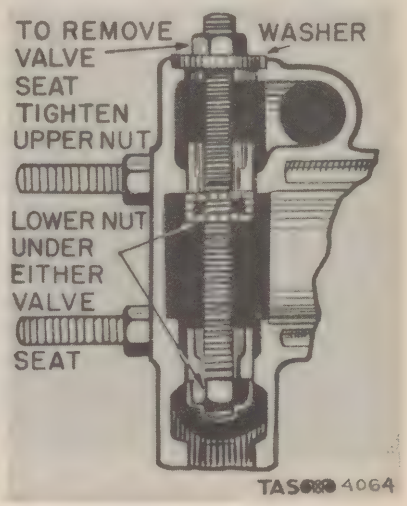


Figure 96. Valve Seat Remover

c. Cylinder. The porcelain-lined cylinders may become worn or damaged and require replacement. Steps in disassembling a cylinder are as follows:

(1) Remove side cylinder heads. (See figs. 66 and 83)

(2) Remove plunger assemblies. (See figs. 84 and 85)

(3) Disconnect the relief valve. (Fig. 97)

Figure 97. Disconnecting the Relief Valve

Figure 98. Disconnecting the Intake (Suction) Pipe.

(4) Disconnect the intake (suction) pipe. (Fig. 98)

(5) Disconnect the injector line. (Fig. 99)

(6) Remove eight (8) stud nuts from side of pump. (Fig. 100)

(7) Remove pump head. (Fig. 101)

(8) Remove cylinders. (Fig. 102) Great care must be taken when replacing gaskets. Nuts must be carefully and evenly tightened if gasket failure is to be avoided.

Figure 99. Disconnecting the Injector Line.

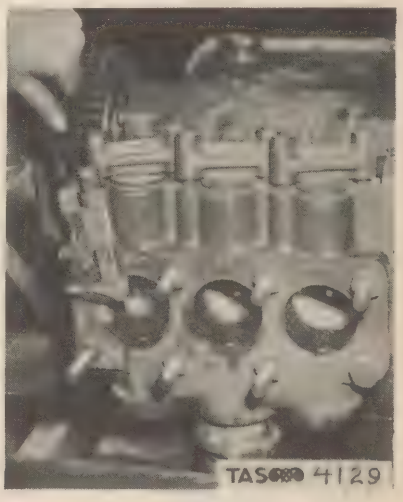


Figure 100. Removing Eight (8) Stud Nuts.

Figure 101. Removing Pump Head.

Figure 102. Removing a Cylinder.

Figure 103. Loosening the Adjusting Nut.

d. Relief valve. In the course of time bleach will cause considerable corrosion to the working parts of the relief valve. This should be disassembled, as here shown, parts cleaned, and when necessary, replaced. The operation is as follows:

(1) Loosen the adjusting nut. (Fig. 103)

Figure 104. Removing the Adjusting Nut.

(2) Remove the adjusting nut. (Fig. 104)

(3) Remove four (4) stud bolts. (Fig. 105)

Figure 105. Removing Four (4) Stud Bolts.

(4) Remove the spring housing. (Fig. 106)

Figure 106. Removing Spring Housing.

Figure 107. Removing Upper Spring Seat.

(5) Remove the upper spring seat. (Fig. 107)

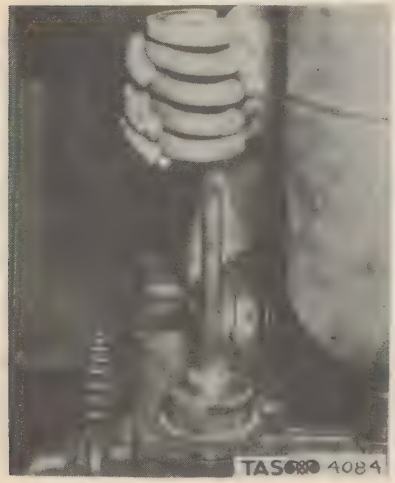


Figure 108. Removing Spring.

(6) Remove the spring. (Fig. 108)

(7) Remove the stem and lower seat assembly. (Fig. 109)

Figure 109. Removing Stem and Lower Seat Assembly.

(8) Remove the cylinder (sleeve). (Fig. 110)

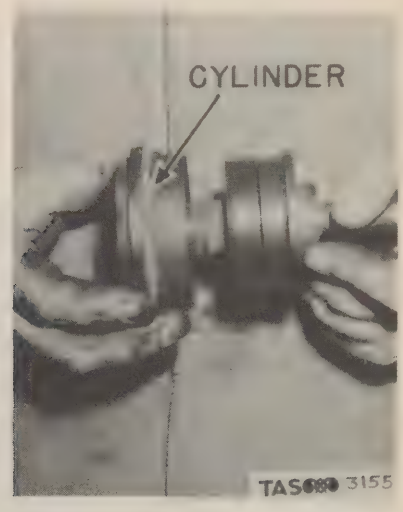


Figure 110. Removing Cylinder (Sleeve).

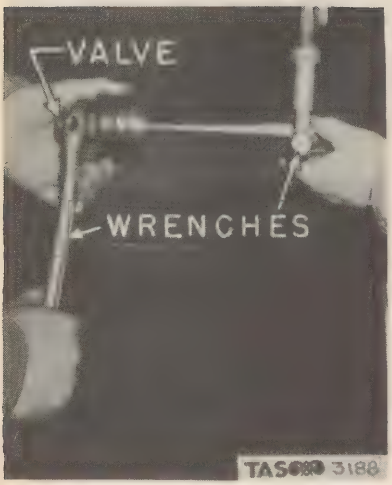


Figure 111. Loosening the Valve.

(9) Loosen the valve. (Fig. 111)

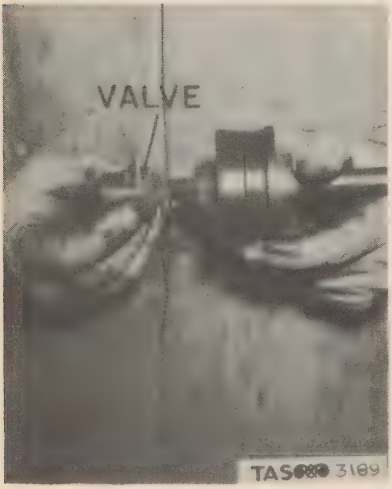


Figure 112. Removing the Valve.

(10) Remove the valve. (Fig. 112)

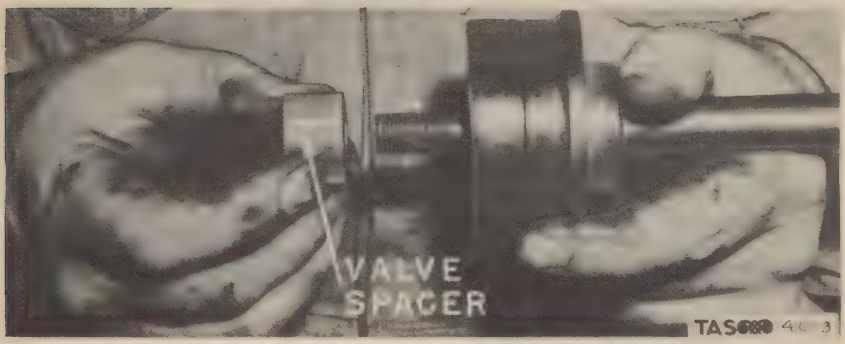


Figure 113. Removing Valve Spacer.

(11) Remove the valve spacer. (Fig. 113)

(12) Attach the valve and loosen the washer. (Fig. 114)

Figure 114. Attaching Valve and Loosening Washer.

Figure 115. Removing Steel Washer.

(13) Remove the steel washer. (Fig. 115)

(14) Remove the hydraulic (neoprene) cup. (Fig. 116)

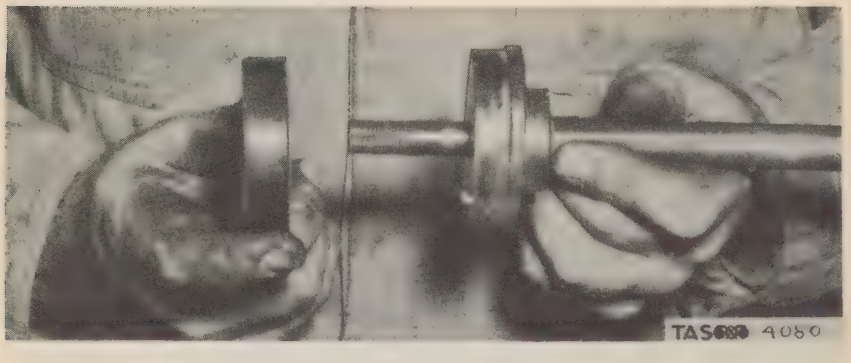


Figure 116. Removing Hydraulic (Neoprene) Cup.

(15) Apply "castor dag" (fig. 117) so that the unit will slip easily into the cylinder. (Components of the stem and seat assembly must be carefully reassembled after cleaning and replacement of parts.)

Figure 117. Applying "Castor Dag."

(16) Remove the valve seat, using the valve seat remover tool in the same manner as in the removal of the pump valve seat. (Fig. 118)

Figure 118. Removal of Valve Seat.

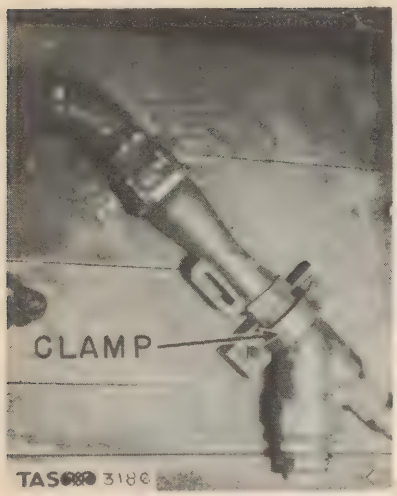


Figure 119. Clamp Holding Injector Assembly to Working Platform.

Figure 120. Assembly Raised

e. Injector. (See figure 119.) The nozzle of the injector assembly will eventually become enlarged by the sand blast effect of suspensions being forced through under high pressure. A nozzle is replaced as follows:

(1) Remove the clamp holding the injector assembly to the working platform. (Fig. 119)

(2) Raise the assembly. (Fig. 120)

(3) Disconnect the inlet body by using wrenches at the points indicated by arrows in figure 120.

Figure 121. Loosening the Nozzle.

(4) Loosen the nozzle from the inlet body with the injector nozzle wrench. (Fig. 121)

(5) Remove and replace the nozzle. (Fig. 122)

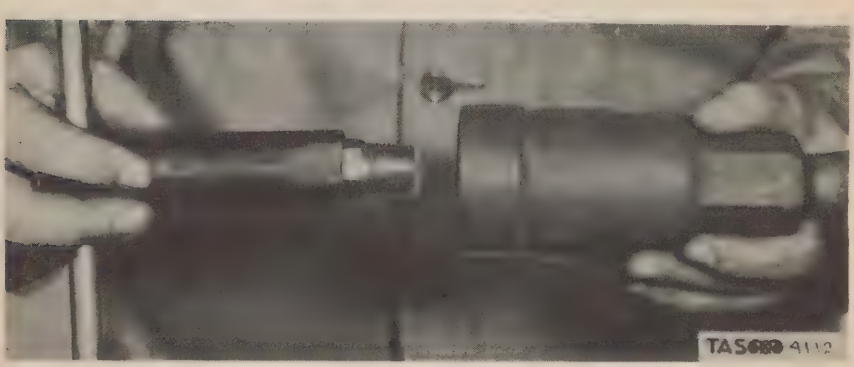


Figure 122. Removal of Nozzle.

f. Agitator paddles: (1) General. Mixing paddles may break if they strike metallic objects such as lids of bleach cans, foreign objects in the bleach supply, or occassionally crystalize with use. Although extra mixing paddles are provided with each apparatus, they are difficult to install. Normally the removal and replacement of mixing paddles in the Bean apparatus is third echelon maintenance. However, if a chemical maintenance company is not available the work can be performed by a skilled mechanic.

(2) Replacement procedure. To replace agitator paddles, the following steps must be taken:

(a) Loosen the agitator chain tightener.

(b) Remove the chain from the sprocket without disconnecting the chain at the master link. If this is not possible, then disconnect the chain at the master link.

(c) Loosen the small locking stud on the sprocket.

(d) Loosen the two studs on the sprocket that form the locking clamp of the sprocket to the agitator shaft.

(e) Loosen the two collars located on each end of the shaft within the tank.

(f) Loosen the front agitator paddle and slip it back on the shaft.

(g) Slip the agitator shaft forward toward the pump until the rear of the shaft clears the rear thrust bearing housing by at least 4 inches.

(h) Loosen the paddles on the agitator shaft and slip them off the end of the shaft until the defective paddle has been reached. Remove this paddle in the same manner and replace it with a spare paddle from the spare equipment chest.

(i) Care should be taken not to lose the key out of the forward end of the shaft that holds the sprocket to the shaft.

(j) When replacing the chain on the sprocket care should be taken to insure that it is in proper alinement. This is easily checked by use of a straight edge placed against the two opposite sides of the chain.

g. Chains. (1) General. The agitator and pump drive chains are of similar design. Loose chains should be tightened as explained in paragraph 14 e. If possible a broken chain is repaired by replacing the damaged link with a spare half-link, but if the chain is severely worn or damaged it must be replaced by a new chain.

(2) Removal and replacement of pump and agitator chains. The following steps describe the removal and replacement of the pump and agitator chains:

(a) If a chain has broken a link during operation, the chain will be thrown from its sprockets.

(b) If a chain is to be removed for cleaning or to have its length adjusted it will be necessary to move the chain idler (figures 62 and 82) to its slack position, remove the master (connecting) link (figures 123, 124, and 125) and lift the chain from the pump.

(c) The old chain should be thoroughly washed in kerosene or gasoline, soaked in a pan of good grade engine oil, and hung up to allow the excess oil to drain.

(d) When replacing the old chain, or installing a new one, drape the slack of the chain over the pump or agitator sprocket, taking care to avoid fouling it with dirt or grit. Move

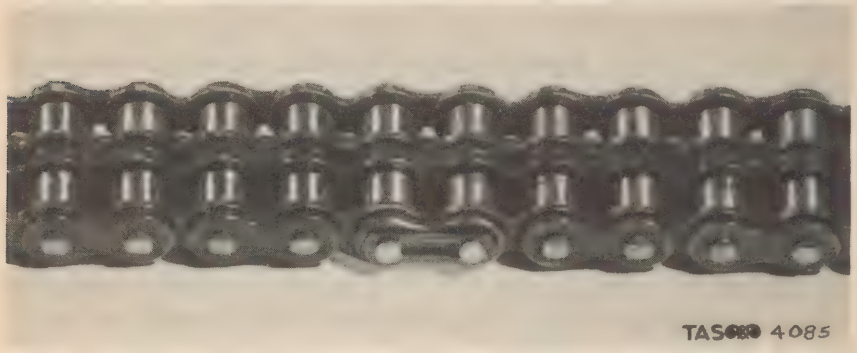


Figure 123. Master (Connecting) Link Holding Chain Together.

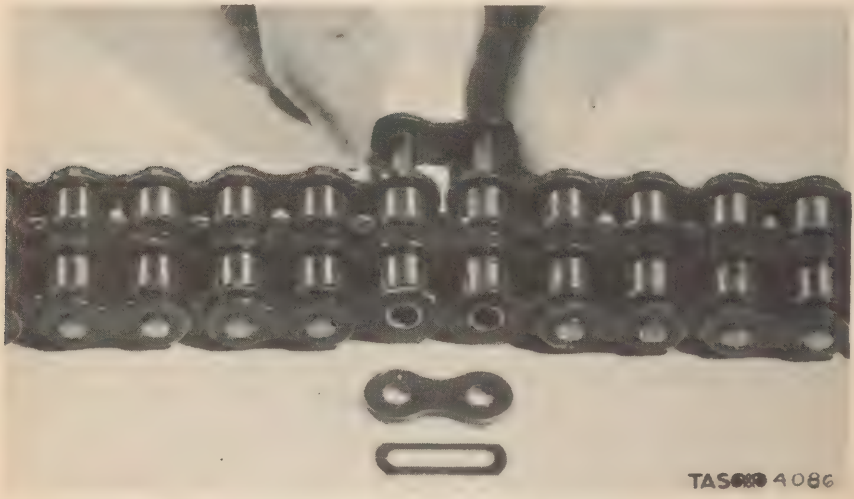


Figure 124. Removing the Master (Connecting) Link.

the chain idler (figure 62) to its slack position if not already done. Fasten a length of stiff wire to one end of the chain and without removing the hood protecting the sprocket, slip the wire beneath the sprocket and draw the chain after it. If this procedure fails it is necessary to remove the hood. Place the chain onto the teeth of the sprocket, draw the two ends together and fasten with the master (connecting) link (figure 123). To make the fastening of the chain ends easier it is suggested that the ends be wired together while inserting the master (connecting) link.

(e) Adjust the chain idler to the proper tension. (See paragraph 14 e.)

(3) Attachment of half-links. (a) Clean the chain as prescribed in the previous paragraph.

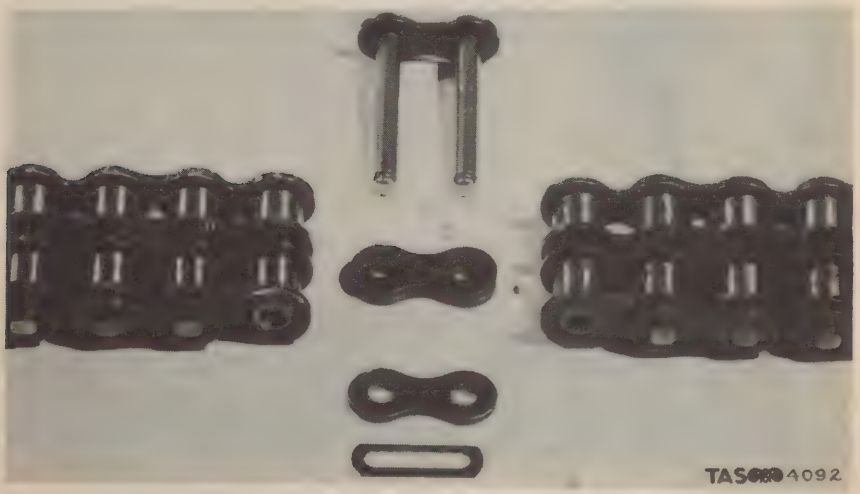


Figure 125. Master (Connecting) Link Disassembled.

(b) Remove the damaged link.

(c) Attach the half-link as shown in figures 126, 127, and 128. Take care to insert the pin in such a way that the

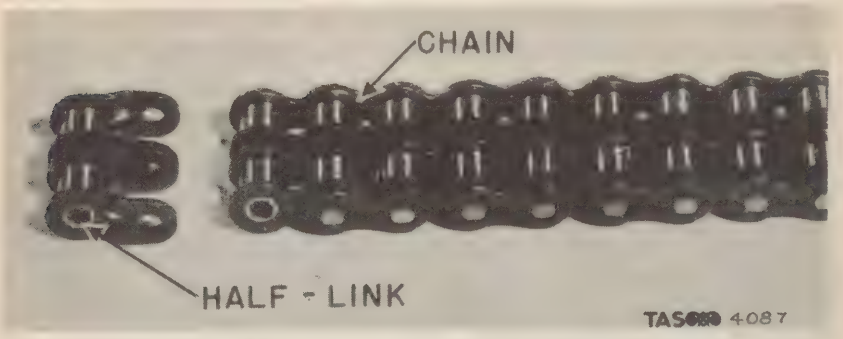


Figure 126. Attaching a Half-Link (1).

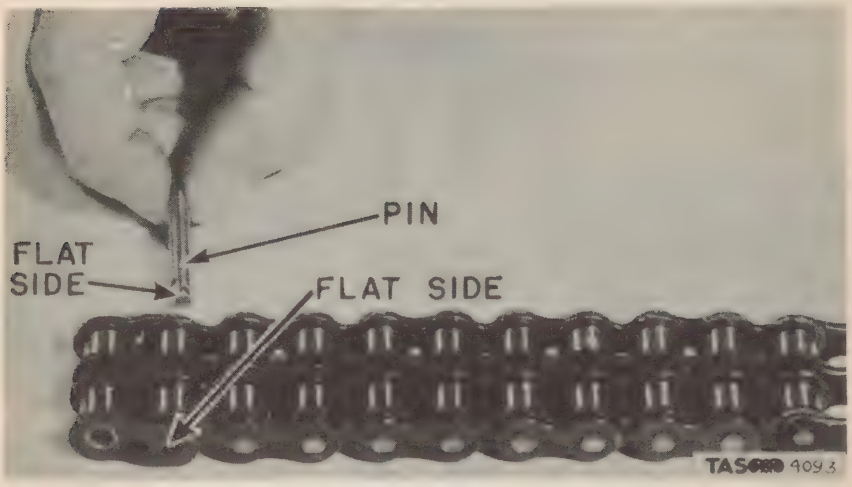


Figure 127. Attaching a Half-Link (2).

flattened part on the end comes in contact with the flat side of the hole in the half-link. Insert a cotter key in each end of the pin and secure it by spreading its prongs.

(d) Oil the chain and replace on apparatus.

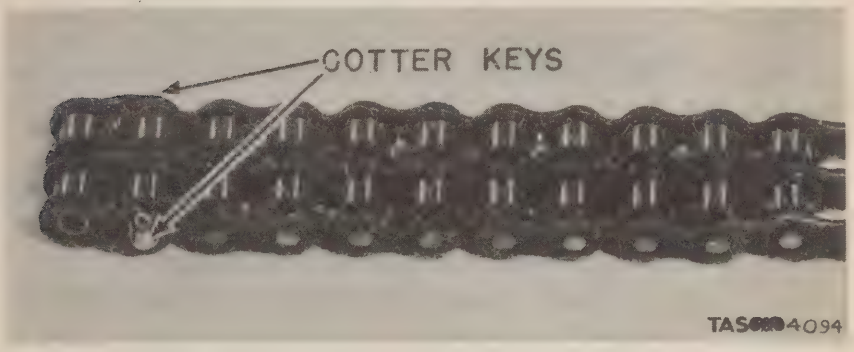


Figure 128. Attaching a Half-Link (3).

16. TROUBLE - COMMON CAUSES OF PRESSURE DROP. a. General. It must not immediately be assumed that the nut on top of the relief valve needs tightening. After this nut is once set for a given pressure the adjustment will not change. Also, it must not be assumed that the engine is running too slowly, though it must be running fast enough for normal pump capacity. First observe the overflow from the relief valve back into the tank. If an even flow of liquid is coming back into the tank through the overflow pipe and the pressure is low, the trouble is at the valve in the relief valve--a worn valve or valve seat, or dirt lodged between them.

b. Uneven flow of liquid into tank through overflow pipe. If there is an uneven flow of liquid coming back into the tank through the overflow pipe, look for:

(1) Worn plunger packing cup. Worn packing will also usually be indicated by water dripping from under the pump.

(2) Worn or dirty pump valves. The balls and seats may be worn and in need of replacement, or there may be dirt lodged between the ball and seat. The spring between the valve ball and the cylinder head may be missing.

c. No overflow from relief valve into tank. If there is no overflow from the relief valve back into the tank it may be assumed that the trouble is not in the relief valve, and the following should be checked:

(1) Look for leakage in the tank return valve. This valve must be tightly closed when the pump is under pressure.

(2) Discharge nozzles may be worn, making the holes too large for the pump capacity.

(3) Look for worn plunger packing cups--indicated by dripping from under the pump.

(4) Clogged bleach intake strainer--usually indicated by pounding in the pump.

(5) Air leak in the suction line. The pipe connections and hose must be airtight.

(6) Air lock--caused by running the pump without water circulating. Release the air lock by opening the tank return valve, which will allow air to escape.

(7) Pump valves may be worn or dirty.

(8) A worn injector nozzle will cause a serious drop in pressure.

(9) The bleach intake or discharge lines may be clogged.

(10) The pressure gage may be so worn or damaged that it does not indicate as high a pressure as actually exists.

Figure 129. The "Friend" M3A1 400-Gallon Power-Driven Decontaminating Apparatus.

SECTION III

M3A1 - "FRIEND"

17. DESCRIPTION. a. General. The "Friend" M3A1 apparatus has its own distinctive pump and automatic pressure controller. It can be identified by means of a name-plate on the top front side of the pump. (Fig. 189) It may also be identified by the location of its valves. No valves are on the left side of the apparatus, but four large gate valves and a pressure gage are placed on the right side of the 400-gallon tank. (Fig. 129)

b. Pump assembly. The pump is a 4-cylinder high-pressure pump. Its principal parts are readily accessible. Gears and bearings are completely enclosed and operate in a bath of oil. The "Friend" pump differs from other M3A1 pump designs in that it consists essentially of opposed metal plungers which are driven back and forth through cylinders lined with packing rings.

c. Injector assembly. The injector, sometimes known as the tank filler, is a device used for speedy filling of the tank with water from a pond or stream, and will lift water upwards to 20 feet. Water coming from the pump is forced through the injector body under high pressure from the injector feed line.

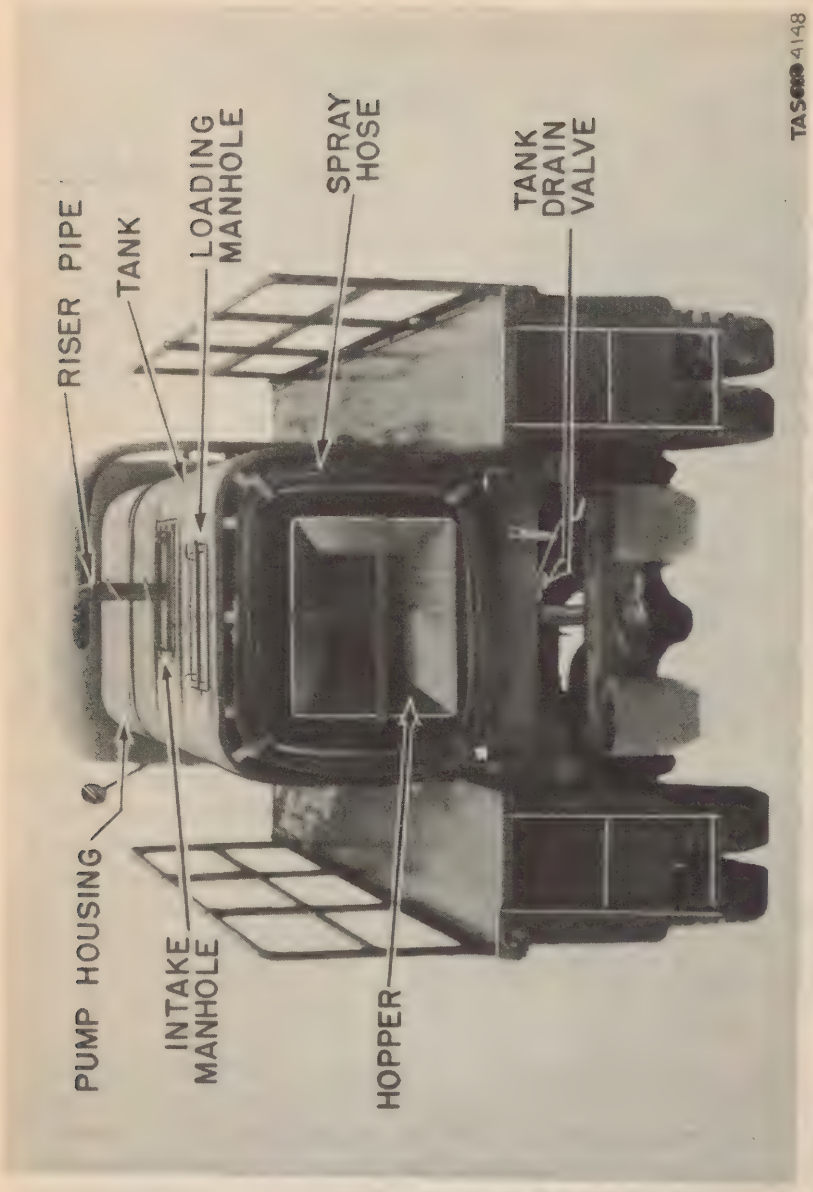


Figure 130. Rear View of the "Friend" M3A1.

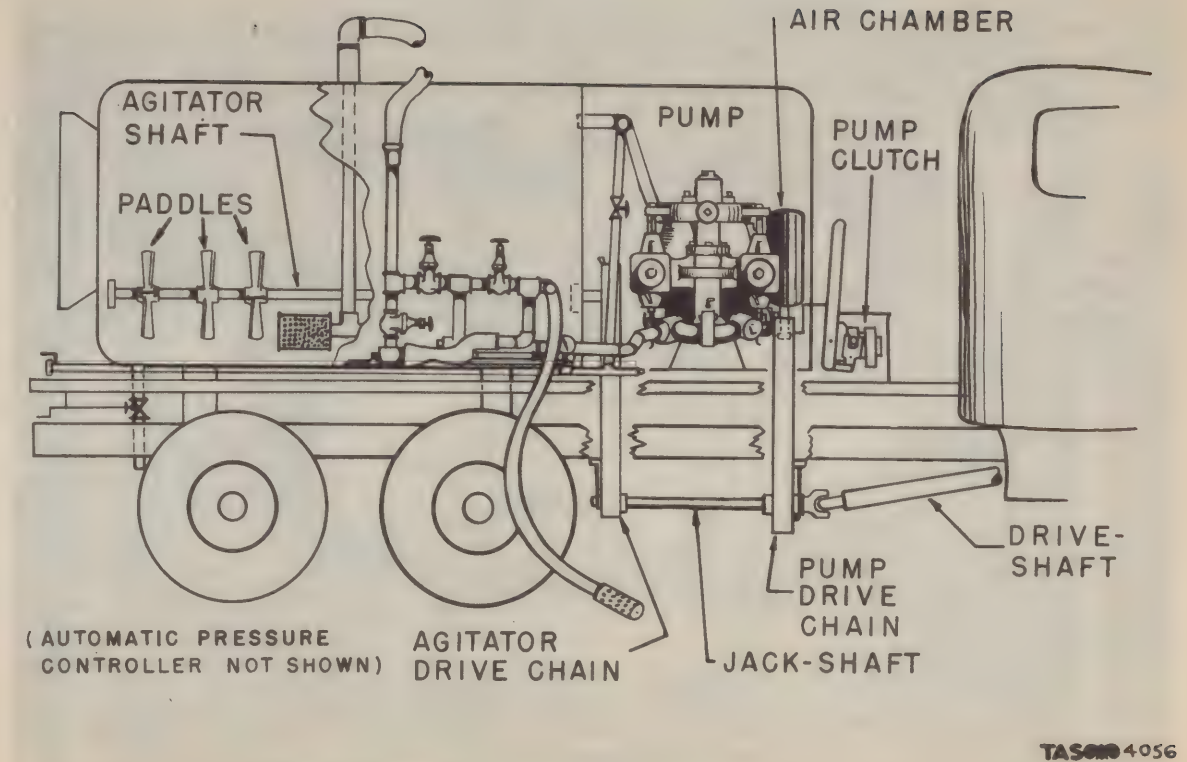


Figure 131. General Arrangement of Parts.

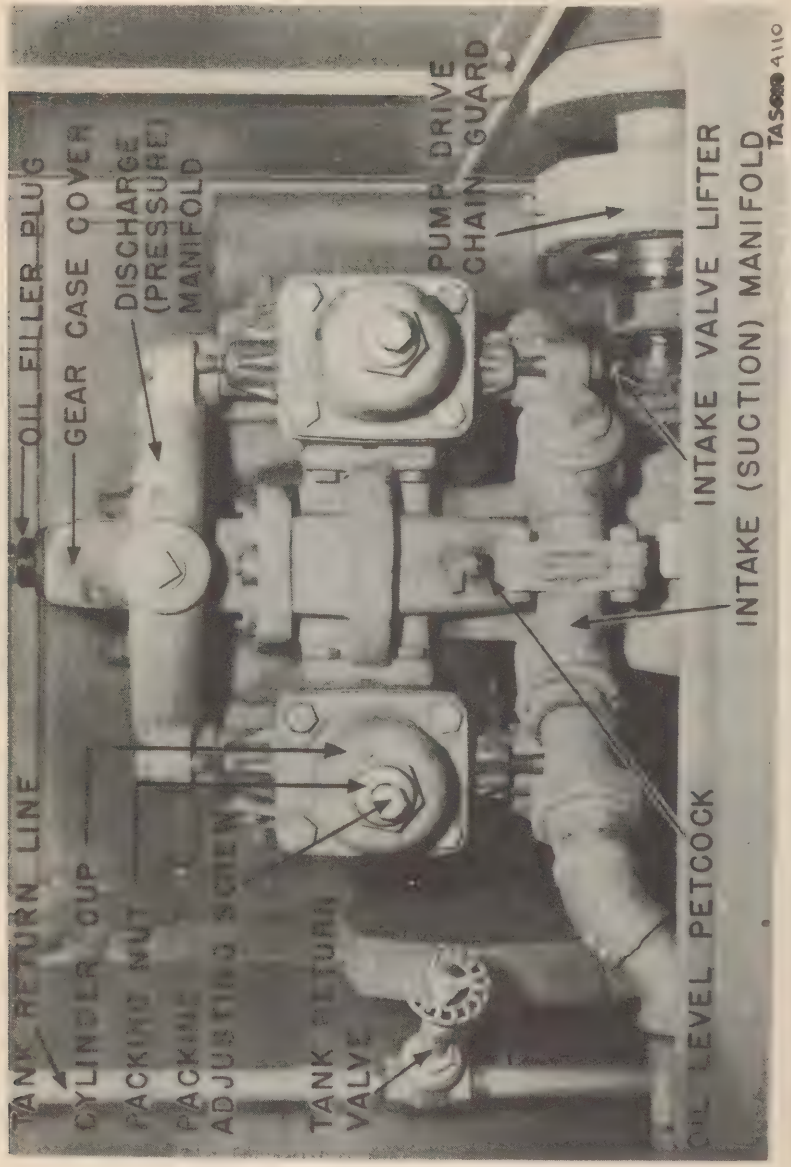


Figure 132. Right Side of Pump Assembly (Rail Removed).

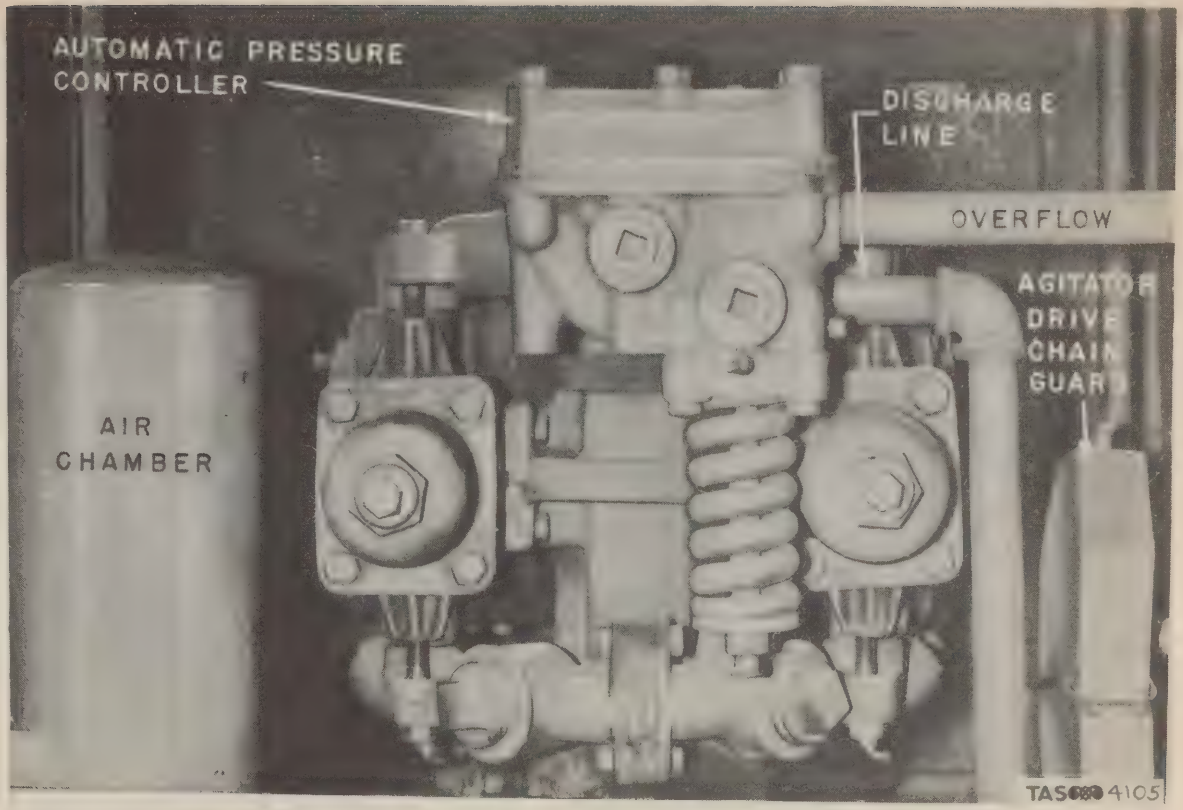


Figure 133. Left Side of Pump Assembly (Rail Removed).

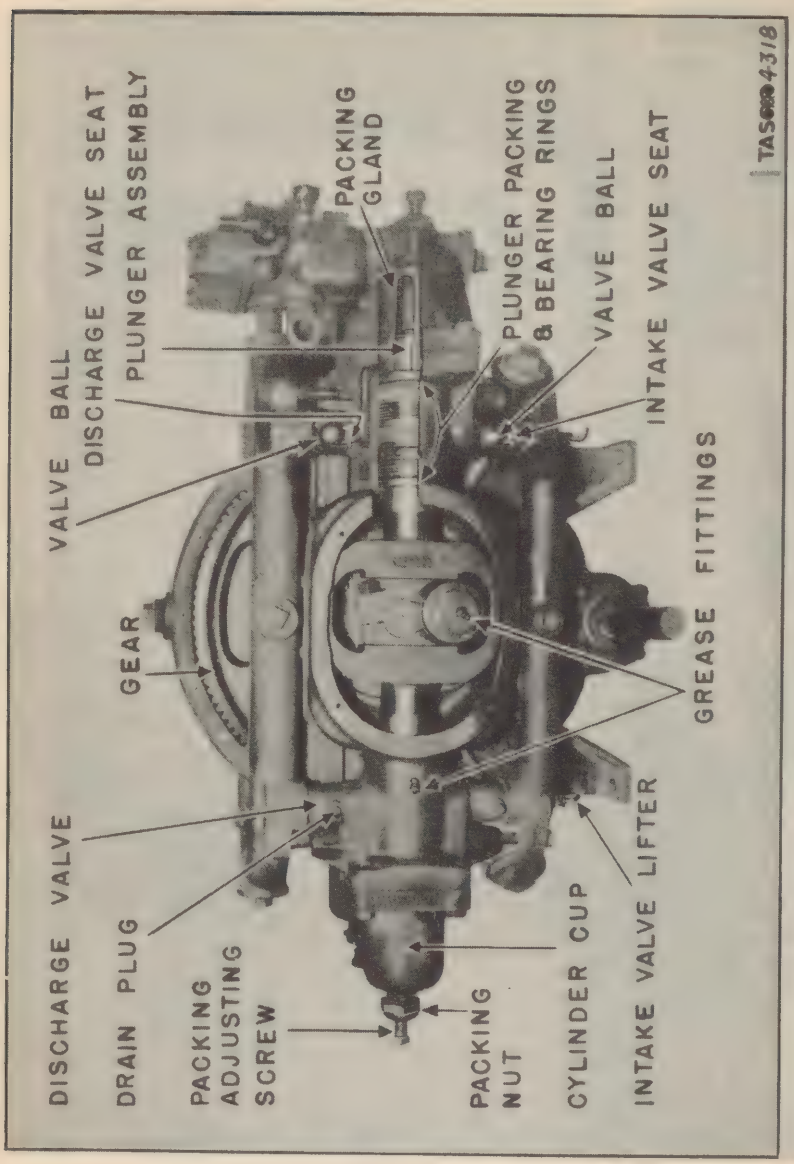


Figure 134. View of Sectionalized Pump.

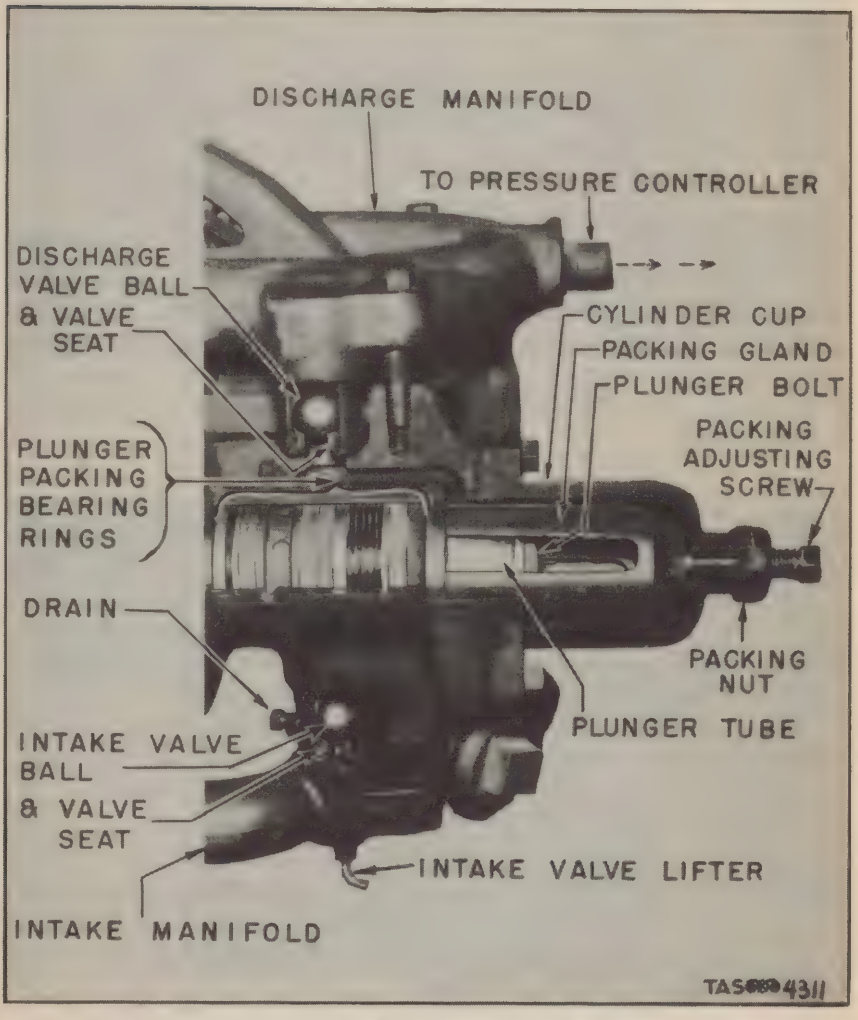


Figure 135. Sectionalized View of Pump Cylinder and Valves.

This high speed stream passing through the injector creates a suction behind it, drawing water into the tank at the approximate rate of 70 gallons per minute when the truck engine is operating at about three-fourths maximum speed.

d. Automatic pressure controller. (1) General. The pressure controller is a device that maintains a desired maximum pressure in the discharge lines. When the discharge is shut off the overflow valve automatically opens, thus permitting the liquid to overflow under no pressure back into the tank. Liquid enters the pressure controller from the discharge (pressure) manifold of the pump (fig. 135) and passes through the discharge check valve and out the discharge pipe to the spray guns (figs. 137 and 138). Pressure is regulated by the degree of compression of the coiled spring which holds the piston of the controller in position. Compression is adjusted by turning the pressure adjusting nut.

(2) Operation. The automatic pressure controller operates as follows: When the regulator is set at a specific pressure (usually 400 pounds with spray guns open) and spray guns are either partially or completely closed, dangerous pressures would be attained but for the fact that such increased pressure is sufficient to lift the piston in the controller against the compression of the coiled spring. When the piston is lifted the valve lifter comes in contact with the overflow valve ball, raising it off its seat and permitting a free flow of surplus liquid to pass out through the overflow valve and overflow pipe to the tank. This permits the pump to idle, while at the same time the check valve, having closed, holds 400 pounds pressure in the spray guns. The instant a spray gun is opened the overflow valve closes and the check valve opens, thus maintaining a constand pressure in the spray guns.

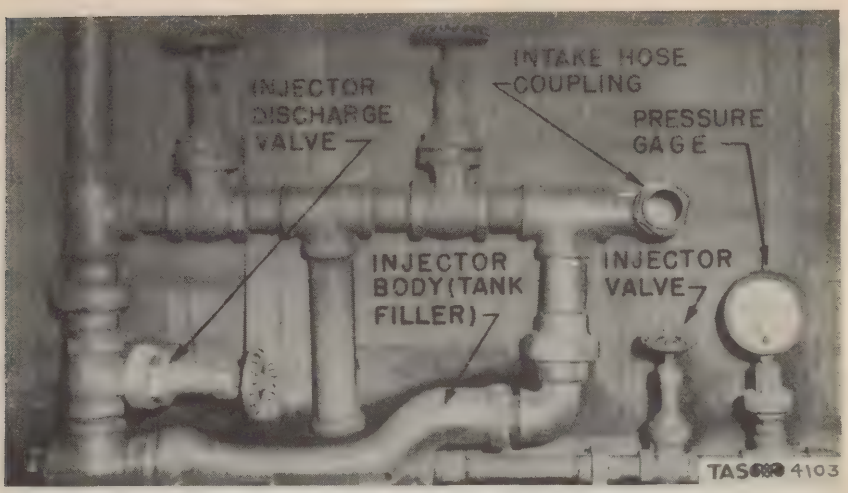


Figure 136. Injector Assembly.

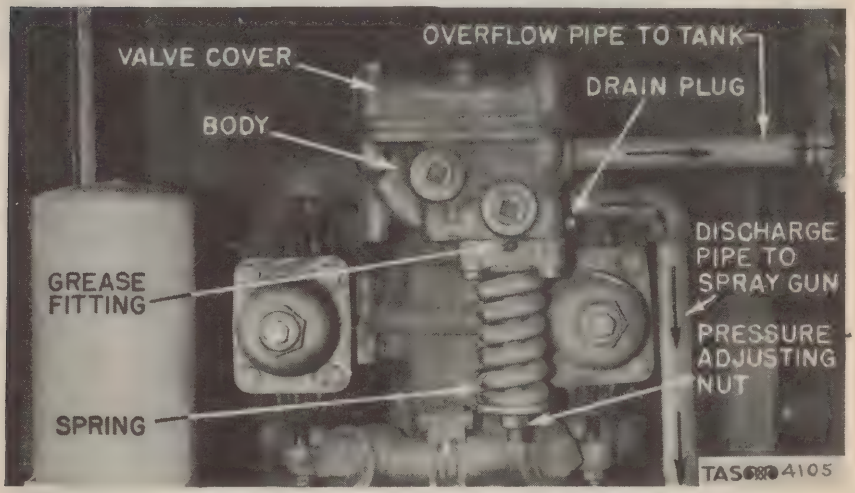


Figure 137. Automatic Pressure Controller.

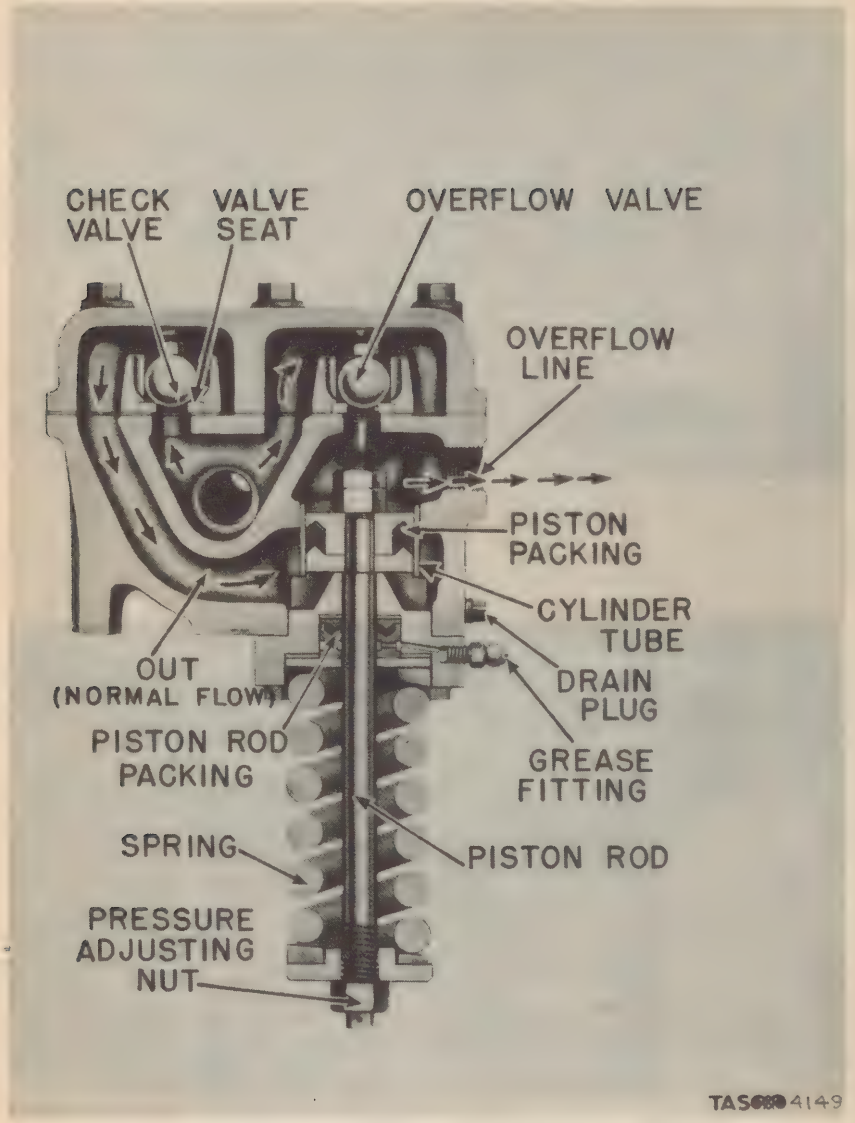


Figure 138. Automatic Pressure Controller.

e. Pump clutch. The clutch is a plate-sleeve type, and is operated by a lever on the side of the truck between the cab and the pump housing. (Fig. 129) The clutch is engaged by shoving the clutch lever toward the rear of the truck.

Figure 139. Pump Clutch and Housing.

Figure 140. Pump Clutch Lever.

f. Tank. The 400-gallon supply tank is constructed of wood and held together by four metal hoop bands. These bands are equipped with tighteners that may be adjusted with the aid of a wrench. Tighteners are on both sides of the tank near the platform.

g. Agitator. The agitator consists of paddles attached to a rotating shaft within the tank. The shaft is connected to the power take-off by a drive chain and sprockets, and is indepen-

Figure 141. The Tank.

Figure 142. Hoop Band Tightener.

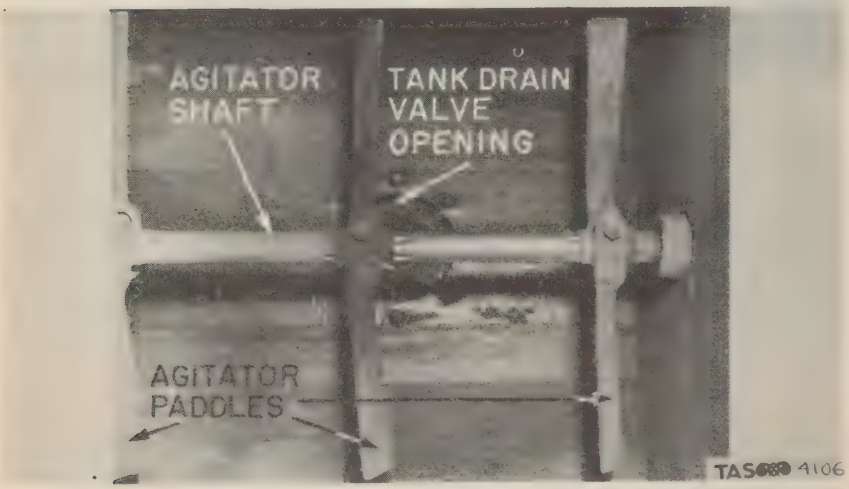


Figure 143. Partial View of Agitator Shaft and Paddles.

dent of the pump drive in order that the agitator may be turning when the pump is at rest.

h. Valves. The manually-operated valves are found on the right side and rear of the tank. The two discharge valves at the rear of the tank are of the plug-cock shut-off type. All others are gate valves. Valves should never be left half-way open, but should be fully opened or closed. The blast of slurry passing under pressure through a half-opened valve will cause uneven wear of valve parts. Furthermore, valves should always be opened or closed in the sequence given in the operating instructions.

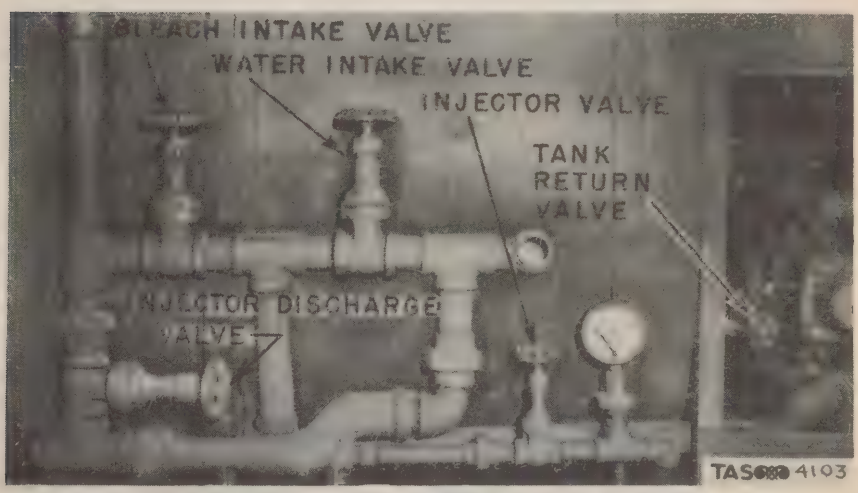


Figure 144. Valves on Side of Truck.

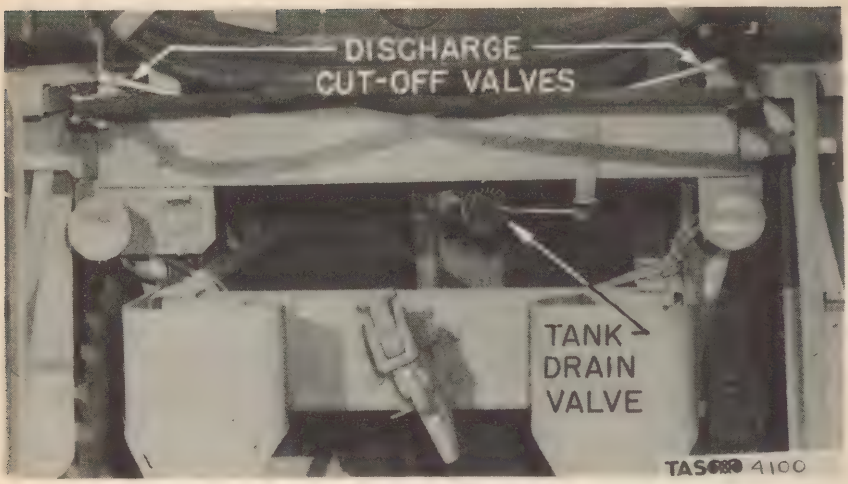


Figure 145. Valves at Rear of Truck.

i. Washing gun. The washing gun is provided for cleaning, and is especially suitable for cleaning the inside of the tank.

j. Spray guns. The spray gun shown in figure 149 is the most common type provided with the "Friend" apparatus. However, some apparatus have been provided with spray guns equipped with Bordeaux type nozzles.

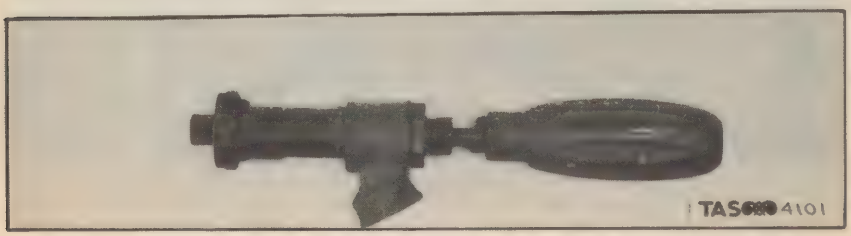


Figure 146. Washing Gun.

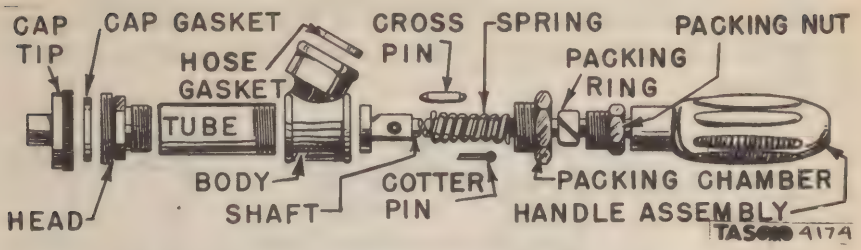


Figure 147. Exploded View of Washing Gun.

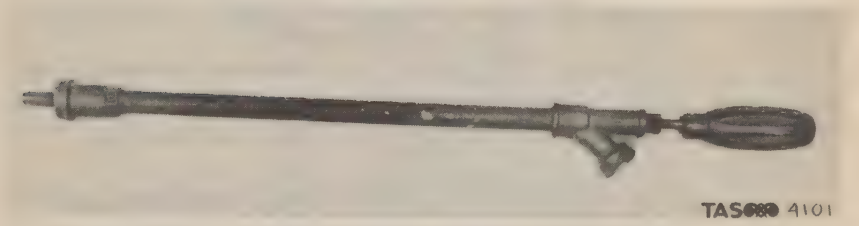


Figure 148. Spray Gun.

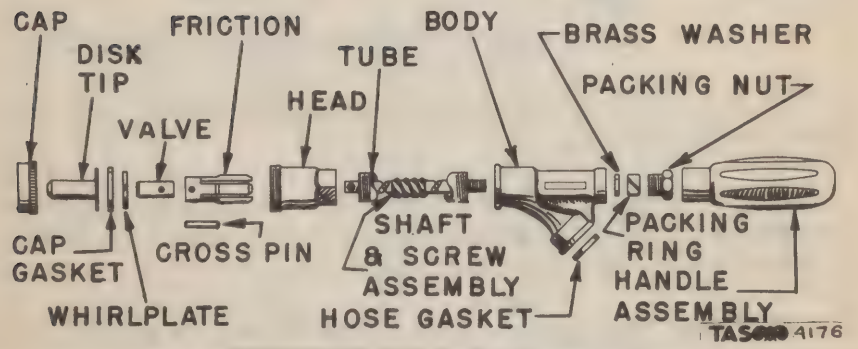


Figure 149. Exploded View of Spray Gun.

18. OPERATION. a. Loading water. (1) Priming. The arrows in figure 150 indicate the flow of water when priming the pump in the course of filling from a stream. The pump is primed as follows:

(a) Close the bleach intake, discharge cut-off, injector, and injector discharge valves.

(b) Open the water intake and tank return valves.

(c) Submerge the intake hose strainer in the water supply.

(d) Start the pump by shoving the clutch lever.

(e) Set the truck throttle about three-fourths open. The pump should soon prime, which will be indicated by water discharging into the tank through the overflow line.

(2) Priming (alternate method). The following filling method may be employed when the tank contains enough water to cover the strainers.

(a) Close the water intake, discharge cut-off, injector, and injector discharge valves.

(b) Open the bleach intake and tank return valves.

(c) Submerge the strainer assembly into the water inside the tank.

(d) Start the pump, setting throttle about three-fourths open. When water discharges at full flow into the tank from the return line, the pump is primed.

(3) Filling with injector tank filler. (Fig. 151) As soon as the pump is primed:

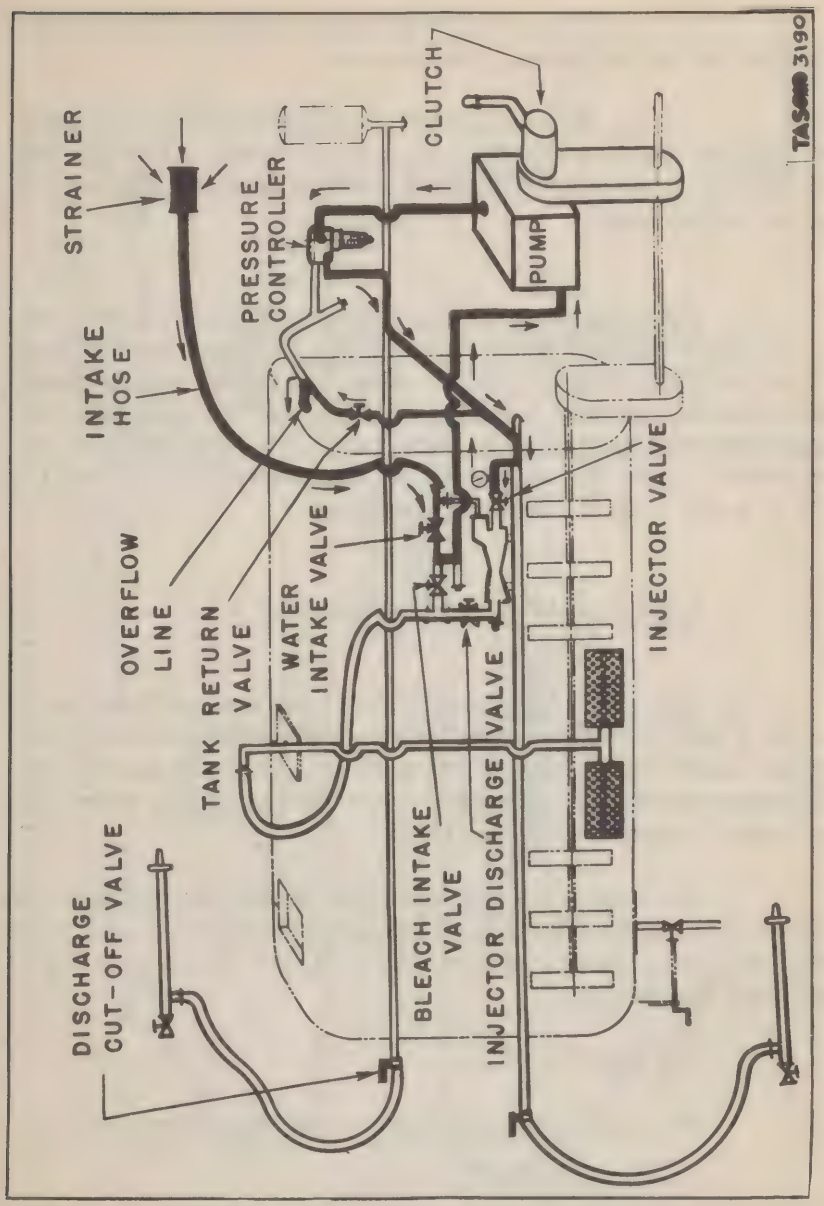


Figure 150. Arrangement of Valves and Flow of Water When Priming Apparatus.

(a) Close the tank return valve and make certain that the water intake valve is open.

(b) When the pressure reaches 400 pounds, open the injector and the injector discharge valves. The injector should then be working and filling the tank at approximately 70 gallons per minute.

b. Pumping water without filling tank. It may sometimes be desirable to pump water direct from a stream without first filling the tank. This procedure may be adopted when washing contaminated vehicles, and is carried out as follows: With the pump primed as described in paragraph 18 a, close the tank return valve, open the discharge cut-off valves, and control the flow of water with the spray gun valves.

c. Loading bleach. See paragraph 6 c.

d. Spraying. (Important). Start the tank agitator while the pump clutch is disengaged. Do not start the pump until after the bleach suspension in the tank is thoroughly mixed. The following procedure is to be used after the bleach and water are thoroughly mixed (see figure 152):

(1) Lower the intake strainers into the liquid in the tank. These strainers must be submerged in the liquid but not lowered to the bottom of the tank until the level of the liquid gets near the bottom.

(2) Start the pump.

(3) Open the bleach intake and tank return valves.

(4) Close all other valves.

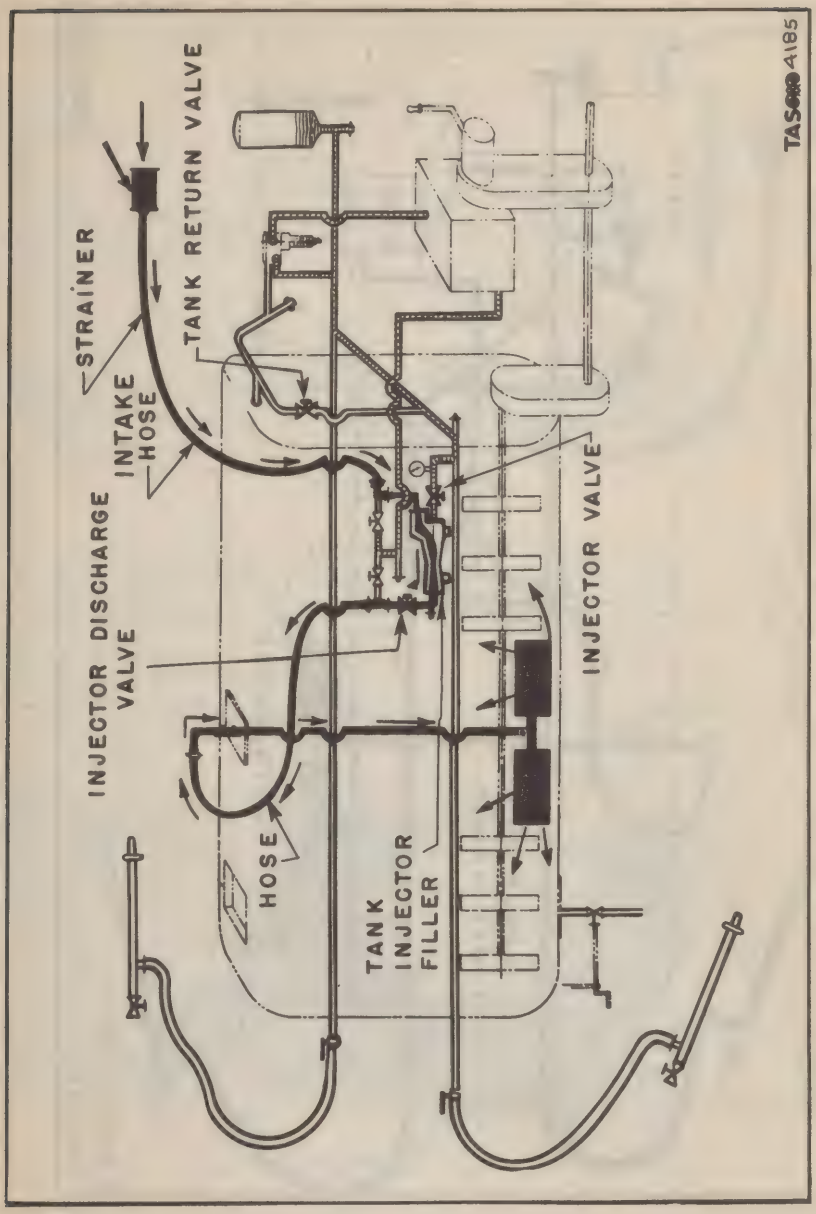


Figure 151. Arrangement of Valves and Flow of Water When Using Tank Injector Filler.

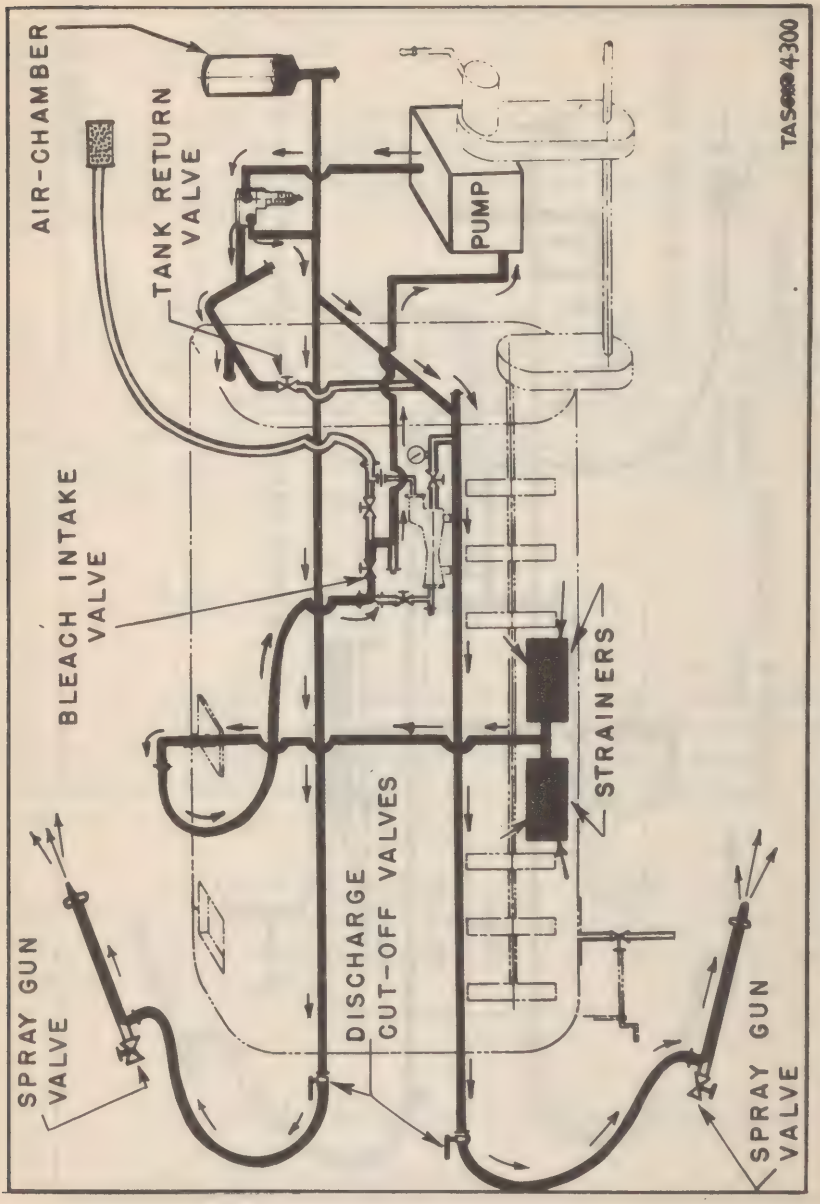


Figure 152. Arrangement of Valves and Flow of Liquid When Spraying.

(5) Set the truck throttle three-fourths open.

(6) As soon as the pump primes, close the tank return valve.

(7) When the pressure reaches 400 pounds, open the discharge cut-off valves and then the spray gun valves and spray as required.

19. TOOLS AND SPARE PARTS. a. Repair kit. The repair kit is installed on the left side of the truck beneath the forward end of the platform. It is similar to that shown in figure 48, and contains a tool box, shovels, and brooms.

b. Tool box. Tools and small replacement parts necessary for second echelon maintenance are carried in the tool box. (See figures 153-157.)

c. Spare equipment chest. Other spare parts are kept in the spare equipment chest. (See figures 158, 159, and 160.)

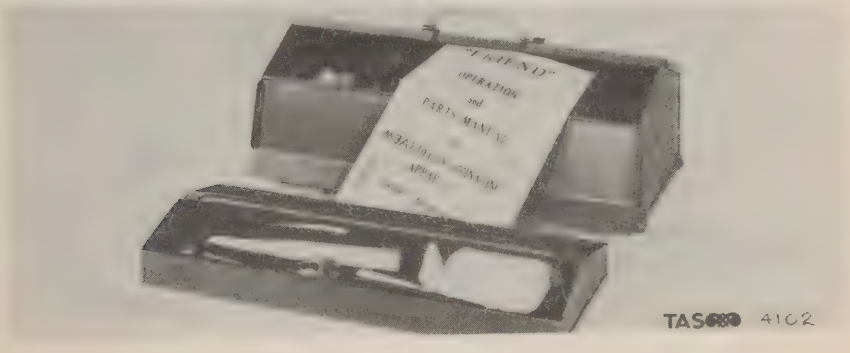


Figure 153. Tool Box.

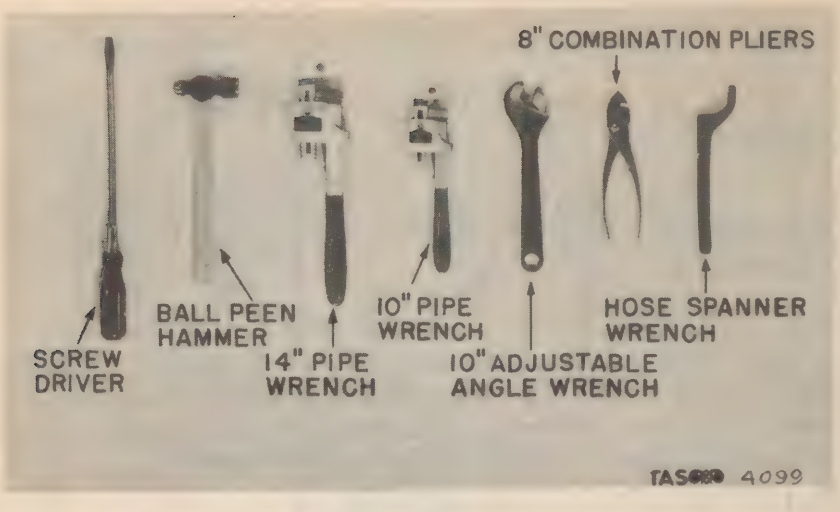


Figure 154. Common Tools in Tool Box.

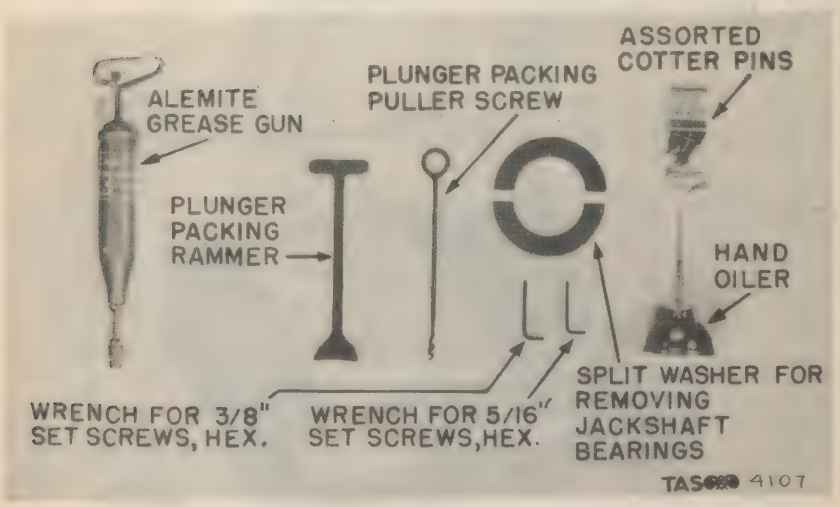


Figure 155. Other Tools in Tool Box.

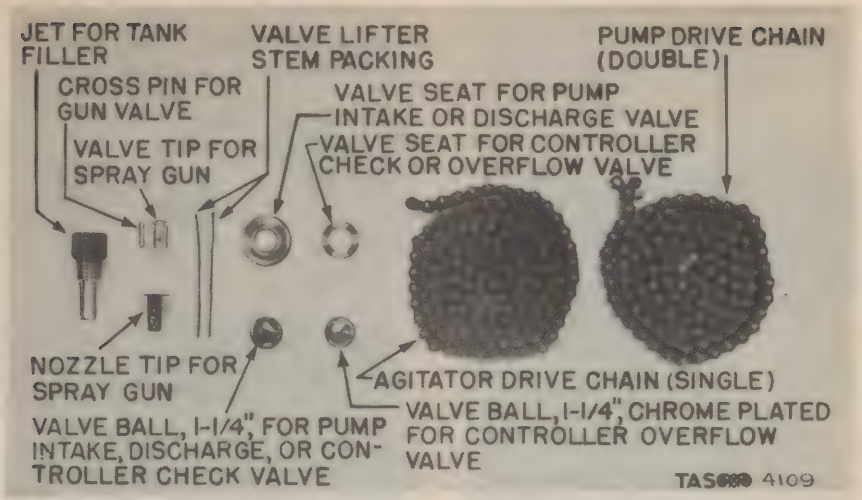


Figure 156. Spare Tools in Tool Box (1).

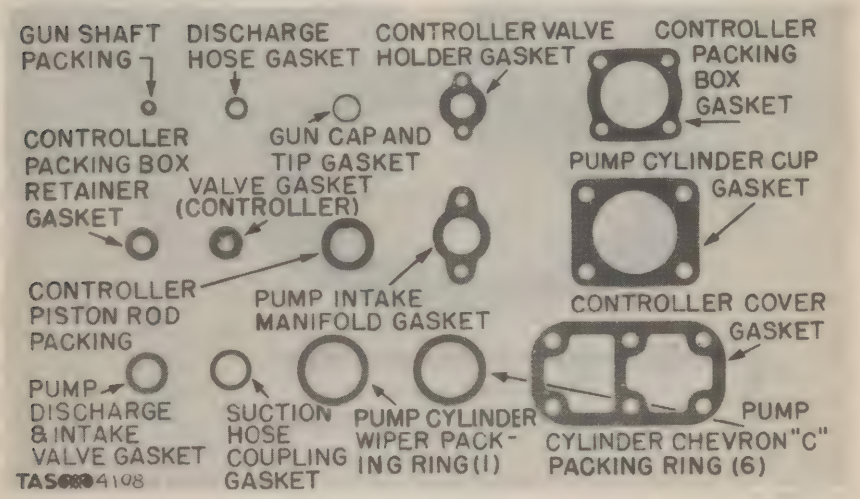


Figure 157. Spare Tools in Tool Box (2).

Figure 158. Spare Equipment Chest.

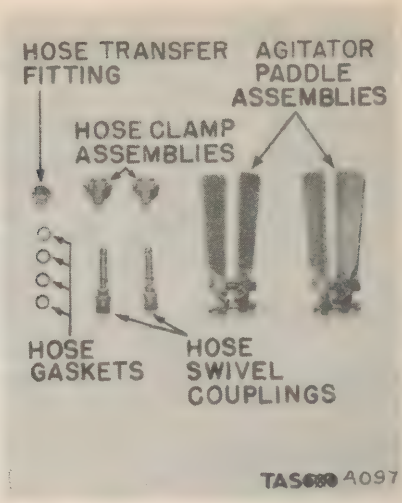


Figure 159. Contents of Spare Equipment Chest (1).

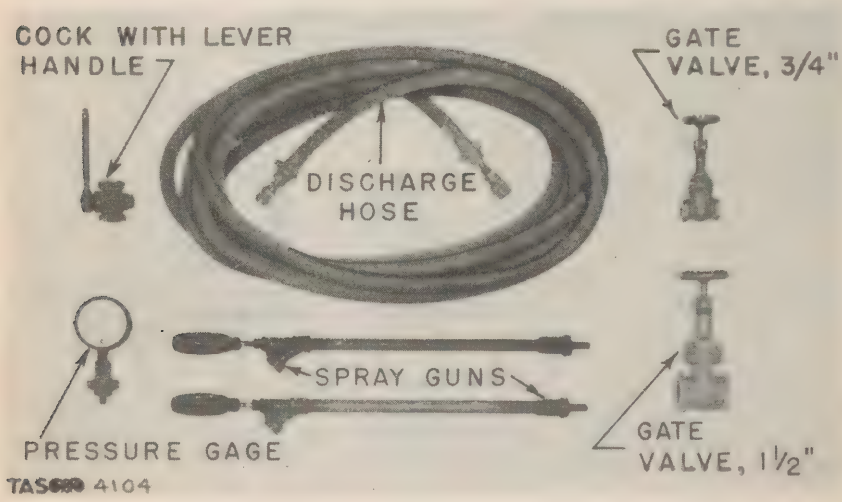


Figure 160. Contents of Spare Equipment Chest (2).

20. SIMPLE MAINTENANCE. a. Lubrication. The following instructions must be carefully observed:

(1) Pump. Keep the pump gear case (fig. 134) filled to above the oil level petcock (fig. 161) with S.A.E. No. 90 light gear oil or S.A.E. No. 50 motor oil. The gear case has a capacity of 1 gallon. Check the oil daily and change it whenever it shows signs of dirt, regardless of how few hours the pump has

Figure 161. Oil Level Petcock.

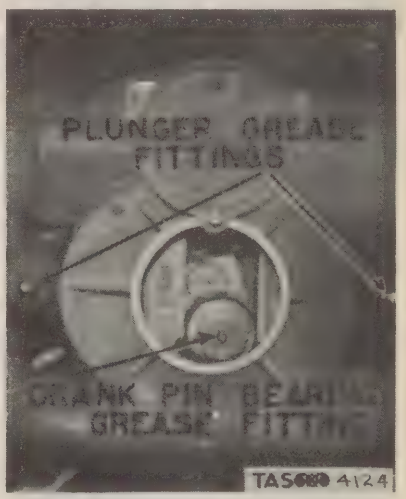


Figure 162. Grease Fittings (1).

run. Normally the oil is changed every 200 to 300 hours of operation. A gear oil may look good and not feel gritty, and yet be unfit for further service. When changing oil the change should be made immediately after the pump has been running and while the oil is warm. Flush the gear case with flushing oil or light-bodied motor oil to remove sludge and dirt accumulations. Drain thoroughly and refill with fresh oil.

(2) Grease fittings. Use a solidified oil lubricant,

smooth lime soap, or a metallic-soap grease. Lubricate each grease fitting, using only the grease gun furnished with the apparatus.

(a) Plungers. (Four fittings. Fig. 162) Lubricate moderately about once each hour. A "shot" or two of grease is enough. A moderate amount of grease at frequent intervals is of prime importance. Excessive lubrication of the plunger will tend to cause the valves to stick. Use only the special grease gun furnished with the apparatus. A high-pressure gun may cause damage.

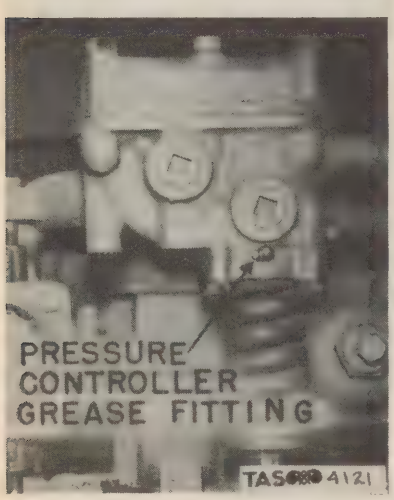


Figure 163. Grease Fittings (2).

Figure 164. Grease Fittings (3).

(b) Crank pin bearings. (Two fittings. Fig. 162) Lubricate after each 4 hours of operation.

(c) Pressure controller. (One fitting. Fig. 163) Lubricate sparingly - a "shot" or two of grease after each 10 hours of operation.

Figure 165. Grease Fittings (4).

Figure 166. Grease Fittings (5).

(d) Pillow blocks. (Four fittings. Figs. 164, 165, and 167) Lubricate thoroughly after each 300 hours of operation.

(e) Chain idler sprockets. (Two fittings. Fig. 166) Lubricate after each 30 hours of operation.

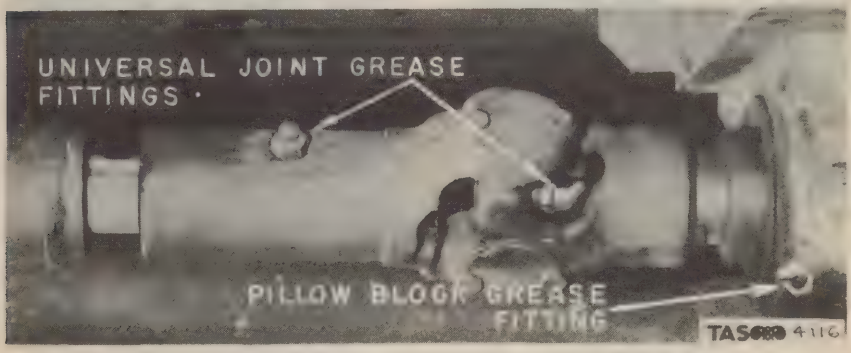


Figure 167. Grease Fittings (6).

(f) Pump clutch. Lubricate the clutch hub and clutch shifter collar after each 10 hours of operation.

(g) Tank agitator shaft bearings. (Two fittings. Figs. 168 and 169) Lubricate thoroughly after each 300 hours of operation.

(h) Truck power take-off shaft universal joints. (Two fittings. Fig. 167) Lubricate thoroughly after each 300 hours of operation.

(i) Roller chains. (Figs. 164 and 168) Lubricate after each 10 hours of operation with S.A.E. No. 20 light motor oil. When chains become dirty they should be removed, washed in kerosene or gasoline, dried, dipped in motor oil, and replaced.

Figure 168. Grease Fittings (7).

Figure 169. Grease Fittings (8).

b. Drainage. Immediately following use, all slurry must be drained from the tank and 100 gallons of fresh water circulated through the pump. It is extremely important that all water be drained from the pump, pressure controller, pipes, tank, and hose whenever there is likelihood of the temperature falling below the freezing point. A freezing temperature will crack the block of an undrained pump. The apparatus should be drained as follows:

(1) Open the bleach intake valve.

(2) Open the tank drain (fig. 145), and tank return valve.

(3) Run the pump only long enough to force out water. (Not longer than 10 seconds). This operation usually expels most of the water but cannot be relied upon for complete drainage.

Figure 170. Removal of Eight (8) Pump Valve Body Drain Plugs.

Figure 171. Raising Upper Valve Ball with Nail.

(4) Remove eight (8) hexagonal head drain plugs from the pump valve bodies (upper and lower). (Fig. 170)

(5) Raise the upper valve balls by inserting a nail or wire through the drain plug openings. Care must be taken not to injure the balls. (Fig. 171)

(6) Remove a 2-1/2-inch drain plug located in the intake manifold under the right front of the pump (fig. 172) and a similar one under the left rear of the pump. (Fig. 173) (Two small drain plugs are also found on the under side of the intake manifold, but these need not be removed inasmuch as the removal of the two larger ones accomplishes the purpose better.)

Figure 172. Right Front Intake Manifold Drain.

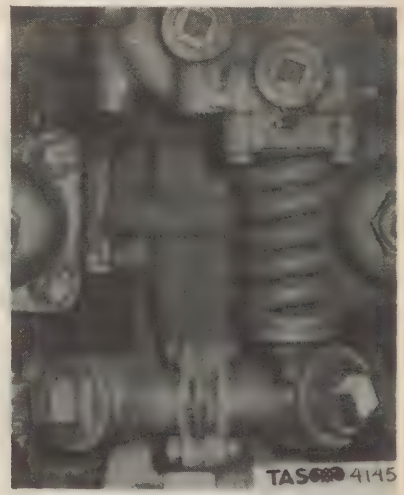
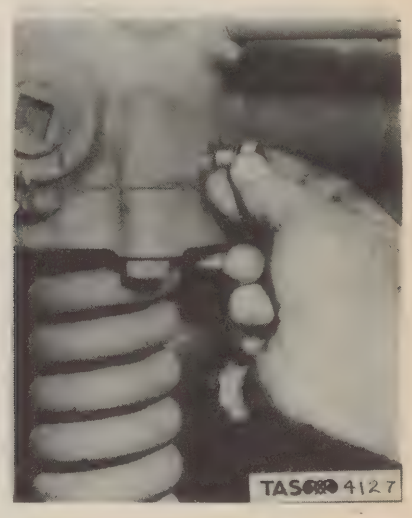


Figure 173. Left Rear Intake Manifold Drain Plug.

(7) Raise the lower valve balls by pushing up on the lifters found under each ball. (Fig. 174)

Figure 174. Lifting Lower Valve Balls.



(8) Remove the hexagonal head drain plug from the pressure controller. (Fig. 175)

Figure 175. Removing Pressure Controller Drain Plug.

Figure 176. Removing Overflow Drain Plug.

(9) Remove the 1-inch drain plug at the lowest point of the overflow line. (Fig. 176)

Figure 177. Air Chamber Drain Plug.

(10) Remove a 3/4-inch drain plug in the air chamber line immediately beneath the air chamber. (Fig. 177)

(11) Remove a 3/4-inch drain plug in the discharge line close to the frame at the right front end of the tank. (Fig. 178)

Figure 178. Removing Drain Plug in Discharge Line.

(12) Remove a 1-inch drain plug in the end of the pump intake line. (Fig. 179)

(13) Remove a 1-1/2-inch drain plug in the end of the injector filler lines. This is close to the frame and in back of the injector filler. (Fig. 179)

Figure 179. Pump Intake and Injector Filler Line Drain Plugs.

(14) Open the four large gate valves found near the pressure gage on the outside of the tank and the small valve in the tank return line. The latter is under the hood near the right front end of the tank. (Fig. 144)

(15) Open the two discharge cut-off valves located at the lower rear of the tank. (Fig. 145)

(16) Drain the two spray hose and guns by uncoiling the hose and opening the spray gun valves.

(17) Check and tightly replace all drain plugs.

21. ADJUSTMENTS. a. Plunger packing. After proper initial adjustment, packing requires no further adjustment during its normal life. Packing adjustment is made by turning the adjusting screw clockwise (fig. 180), which moves the packing gland into the pump cylinder and compresses the packing. The screw should be turned only enough to bring the packing gland

Figure 180. Adjusting Pressure Packing Screw.

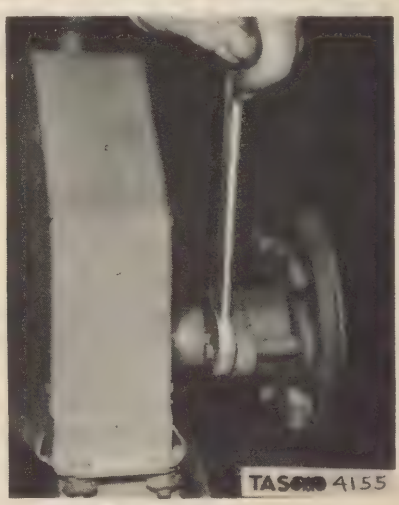


Figure 181. Tightening Packing Box Adjusting Nuts.

firmly against the packing - just enough to prevent end movement of the packing - after which it is given a final half-turn clockwise. This type of packing requires a relatively light gland pressure to function properly. At all times a film of water should be seen where the plunger enters the cylinder; and until this slight oozing becomes a trickle, repacking should not be required. Over-tightening shortens the life of this type of packing and plunger and wastes power. (NOTE: In an emergency, when the pump cannot be shut down for repacking and it leaks excessively, temporary results can be obtained by further tightening the plunger packing a half-turn at a time.)

b. Agitator shaft packing box. The agitator shaft packing box is located at the front end of the tank. It is bronze-bushed to form a bearing for that end of the shaft, the opposite end being held by a bronze bearing. Leakage from the packing box is stopped by tightening the stud nuts (fig. 181) which forces the gland into the box, compressing the five rings of packing. (When replacing packing, make certain that three rings of packing are placed in the bottom of the box first, then the ground and drilled steel lantern grease ring, two more packing rings, and finally the gland.) When making an adjustment, tighten the adjusting nut only enough to prevent leakage, as further tightening will materially shorten the life of the packing due to excessive wear. Lubrication daily or after each 10 hours of operation will prolong the life of the packing as well as lubricate the bronze bushing.

c. Automatic pressure controller. Before making any adjustment to the pressure controller make certain that the pump is operating freely and that all cylinders are working at their full capacity, unobstructed by clogged or inactive valves. Increase the pressure by turning the adjusting nut (fig. 182) clockwise. To decrease pressure, turn the adjusting nut counterclockwise. Adjustments are made with the spray guns shut off. It may be necessary to place a second wrench on the flattened lower end of the piston rod to prevent it from turning while the

adjustment is being made. If the pressure drops when a spray gun or washing gun is opened wide, it may indicate that the gun tip has too large a hole in it, that all pump valves may not be functioning properly, that the throttle may not be advanced sufficiently, or perhaps that the overflow valve may be leaking because of a faulty seat. The last may be checked by observing the overflow discharge. If the size of the orifice in the spray gun is correct for the capacity of the pump, a small stream should be coming through the overflow with the spray gun wide open.

Figure 182. Adjusting Pressure Controller.

d. Pump clutch. To tighten the clutch, lift the metal tongue out of the slot and revolve the slotted adjusting ring clockwise. (Fig. 183) Ordinarily turning the ring one notch to the right will be sufficient. The metal tongue must drop all the way into the slot in order to lock the adjustment. Too tight an adjustment will strain all parts of the clutch; too loose an adjustment will permit slipping and heating of the clutch. Adjust the clutch only tight enough so that it will not slip under a load.

Figure 183. Adjusting the Clutch.

e. Idler sprockets and chain drives. Too tight a chain causes rapid wear while too loose a chain will climb the sprockets. Keep the chains adjusted tight enough to prevent them from slapping against the metal guards. Chains are tightened by loosening the idler sprocket adjusting nut (fig. 184), moving it forward, and retightening. Sprockets must be kept in proper

Figure 184. Agitator Chain Tightener.

alinement. Periodically remove the chain guard and examine the chain. Check with a straight edge if the teeth show signs of wear on one side. When the chain becomes worn and all slack has been taken up, it may be shortened by removing a link and replacing with a half-link.

22. REMOVAL AND REPLACEMENT OF PARTS. a. Dismantling and reassembly of a cylinder. (1) Dismantling. Loosen the packing adjusting screw (fig. 180) and remove the screws holding the cylinder cup. (Fig. 185) The cylinder cup and gland may then be removed. (Fig. 186) Next, rotate the pump drive

Figure 185. Removing Cylinder Cup Screws.

Figure 186. Removing Gland.

until the plunger tube bolt head is outside the cylinder. Then remove the plunger bolt, cap, and plunger tube. (These parts are shown in figure 135.) Do not use a wrench or hammer on the plunger tube as any damage to the end of the tube will prevent proper sealing upon reassembly. Damage to the side wall of the tube will cause rapid wear of packing.

(2) Cleaning. Thorough cleaning of all parts is essential as grit may cause the plungers to score. Scrape and wash the grease ring (shown in figure 187) and cylinder. Clean the ends of the plunger tube, the mating surfaces on the yoke and plunger cap, and the underside of the plunger tube bolt. If the plunger tube is badly worn it should probably be replaced, as new packing will not give satisfactory service with a worn tube.

(3) Plunger replacement. Put white lead or pipe joint compound on the tube ends and mating surfaces of the plunger cap and on the underside of the plunger tube bolt head when replacing a plunger. This is important, as it prevents the possibility of leakage through the inside of the plunger tube.

(4) Repacking. The packing and bearing rings must be installed in the sequence shown in figure 187. Oil the outside of the plunger tube and dip each packing and bearing ring in oil before installing. Make certain that the grease ring is installed in proper relation to the packing, and, when inserting the chevron type rings, insure that the edges are not damaged. It is not necessary to replace the bearing rings when repacking pump plungers unless they show excessive wear. Ordinarily these bearing rings will serve for about three sets of packing. (The bearing rings serve as a bearing for the plungers and have no function as packing.)

(5) Reassembly of the cylinder. It is advisable to use a new cylinder cup gasket when reassembling a cylinder inasmuch as the used one may not withstand the pressure. Unscrew the adjusting screw in the cap so that the gland will go

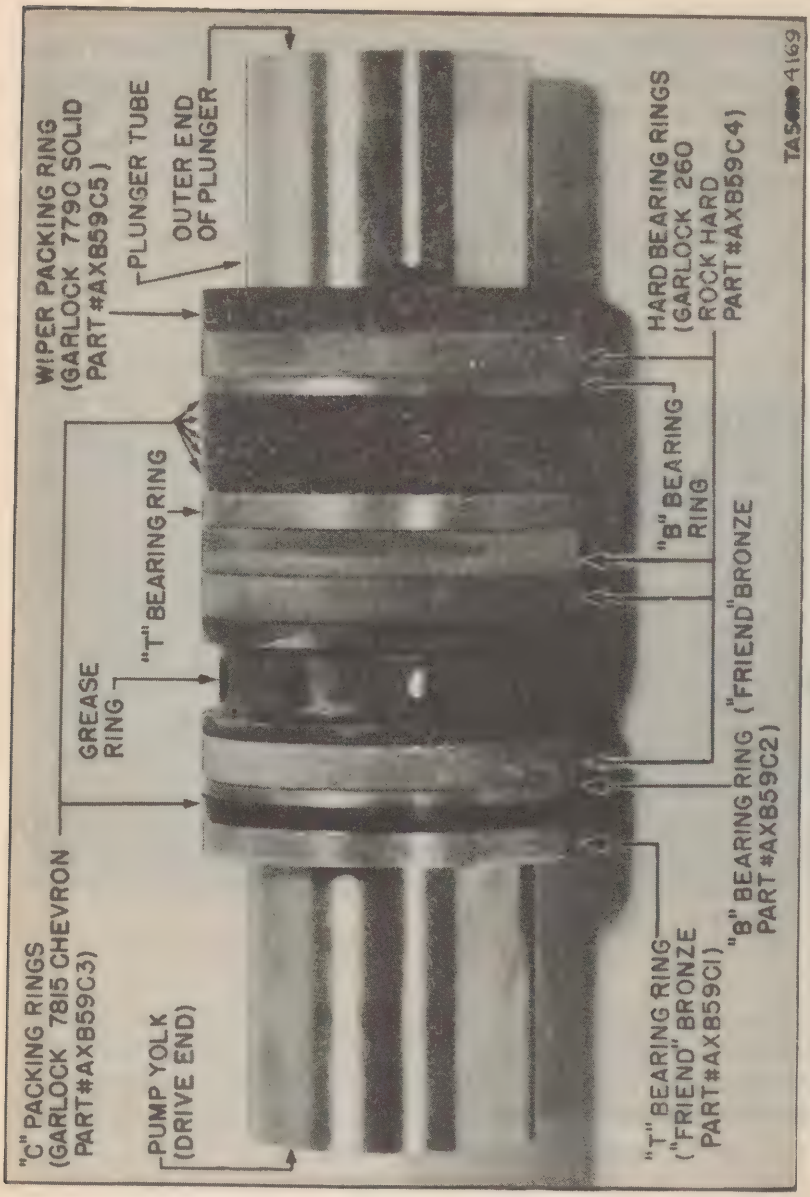


Figure 187. Packing and Bearing Rings.

back inside the cap. With the cylinder cap screws in the cup, place the gasket over them and, with the gland inside the cup, place the assembly over the plunger, making certain that the gland enters the packing box. Tighten cup screws into cylinder flanges, drawing each one snug. Finish the tightening by giving each screw a partial turn at a time to bring uniform pressure on the gasket. If this is not done the gasket will blow out.

b. Pump valve assembly. Pump valve assemblies may be removed by loosening the bolts holding the manifold to the pump (fig. 188), prying up the manifold and slipping out the valve

Figure 188. Loosening Discharge Manifold Bolts Prior to Removal of Valve Cage.

Figure 189. Removal of Valve Cage.

assembly. (Fig. 189) When the valve cage is replaced it must be right side up, with the seat under the cage. (Fig. 190)

Figure 190. Pump Valve Assembly.

Make certain that the valve gasket surfaces are clean, smooth, and carefully placed.

One gasket is placed between the seat and the valve cage (fig. 190), one next to the manifold (fig. 191),

Figure 191. Valve Gasket Next to Manifold.

and another next to the pump. (Fig. 192) The valve seat, cage, and gaskets are placed centrally over the valve parts.

Figure 192. Valve Gasket Next to Pump.

c. Dismantling and reassembly of automatic pressure controller.

(1) Pressure controller valves. Both the check valve and the overflow valve are made accessible by the removal of the six (6) controller cap screws and the valve cover. (Fig. 193) The valve balls can be removed for valve seat inspection by inserting a nail or wire in the side of the valve cage and raising

Figure 193. Removal of Pressure Controller Cap Screws

Figure 194. Controller Valve Balls

the balls to a point where they can be picked up by the fingers. (Fig. 194) Care should be taken not to damage the balls. The check valve ball is stainless steel while the overflow valve ball is chromium-plated to give it greater hardness and make it more resistant to the excessive wear and grooving which develops in the overflow valve only. The overflow valve may be distinguished from the check valve ball by its high lustrous sheen. When cleaning, however, clean and replace one ball before removing the other, and thus eliminate the risk of confusing the balls.

(2) Valve cage assembly. To remove the valve cage assembly, unscrew the two (2) hexagonal valve stud nuts (fig. 195) and lift the valve cage over the studs. When replacing these parts make certain that all gasket surfaces are clean and that gaskets are not damaged. It is a good practice to use new gaskets when possible. Any difficulty experienced in removing

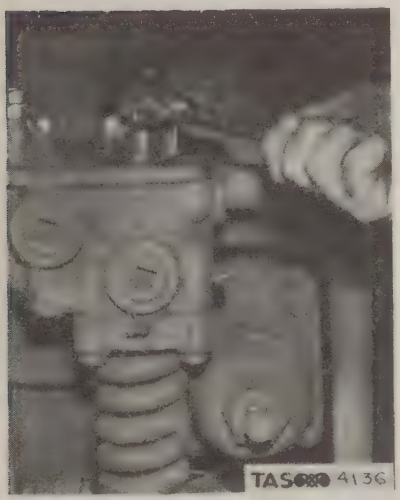


Figure 195. Removal of Valve Cage Assembly.

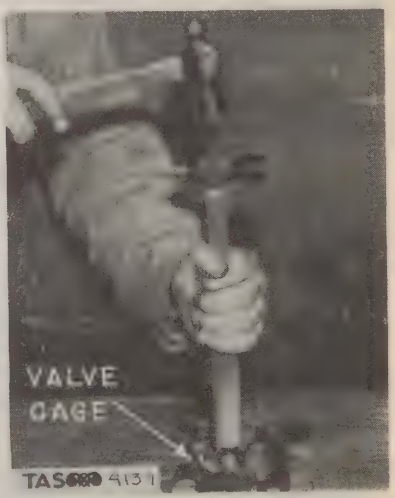


Figure 196. Removing Controller Valve Seat.

a valve seat from a valve cage may be overcome by driving the seat out with a block of wood or hammer handle placed firmly against the seated valve ball to protect it from injury. The valve cage is supported by its outer edges, leaving room beneath the cage for the valve seat to free itself upon being struck. (Fig. 196)

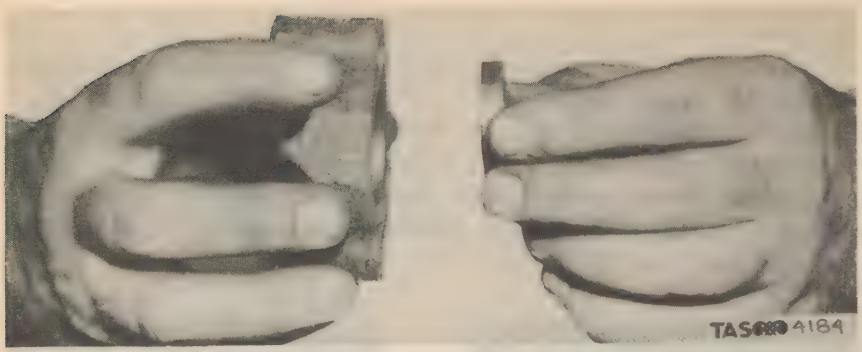


Figure 197. Controller Valve Cage and Seat.

(3) Removing controller valve seat. When controller piston packing needs replacement the piston rod assembly must be taken apart. The first step is to remove the four (4) packing box cap screws (fig. 198), which will permit the removal of the complete piston rod assembly. (Fig. 199) Removal of

Figure 198. Loosening Controller Packing Box Screws.

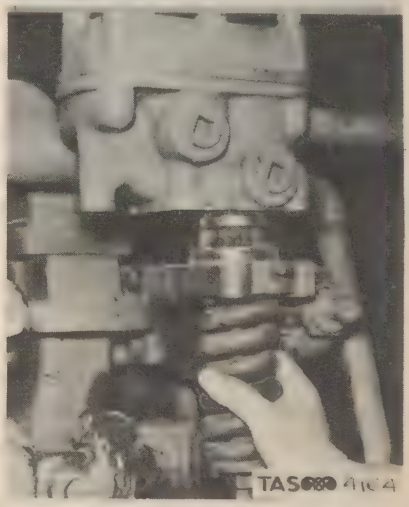


Figure 199. Removal of Piston Rod Assembly.

the piston rod nut and lock nut (fig. 200) will permit the removal of the piston. (Fig. 201) When packing rings are replaced they must be installed with the grooved side towards the spring, care being taken that the packing retainers are in the proper place to fit the shape of the packing. In replacing the piston rod

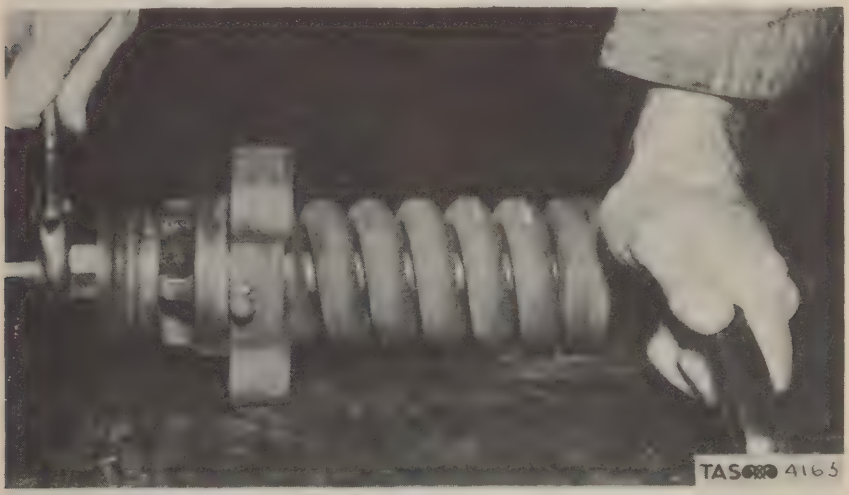


Figure 200. Removal of Piston Rod Nuts.

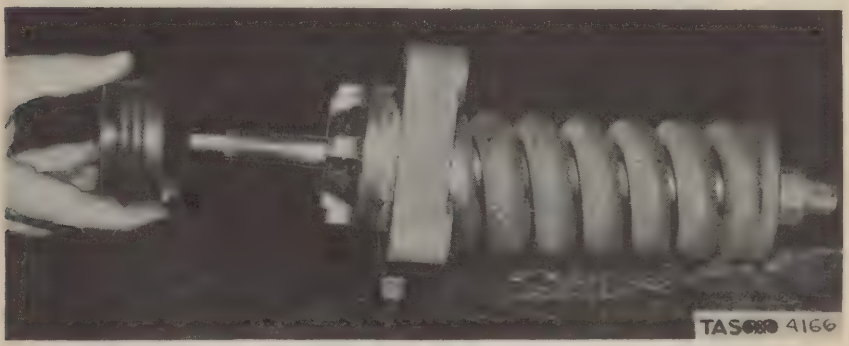


Figure 201. Removal of Controller Piston.

packing, the piston rod is first withdrawn from the packing box (fig. 203) and then the packing withdrawn from the packing box (fig. 204). When new packing is installed the grooved side is placed into the packing box. (The piston rod packing (fig. 205) must not be confused with the piston packing. Fig. 202.) To reassemble, and with new piston rod packing having been placed in the box, put the piston rod up through the box, replace the piston, and tighten the lock nuts evenly and securely. Do not attempt to install packing from the lower end of the piston rod. Its diameter is too great and its threads will injure the packing.

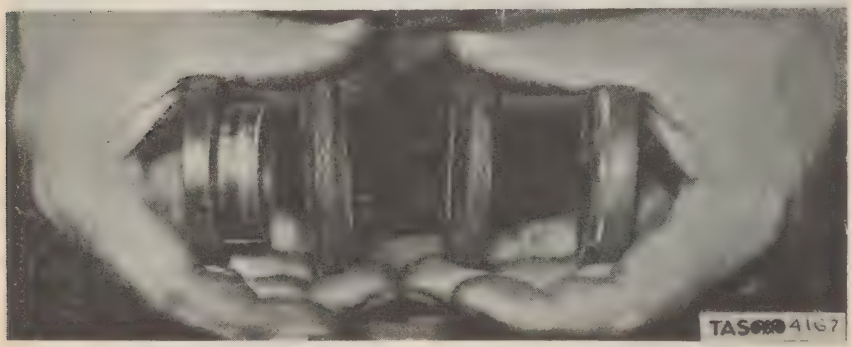


Figure 202. Controller Piston Packing.

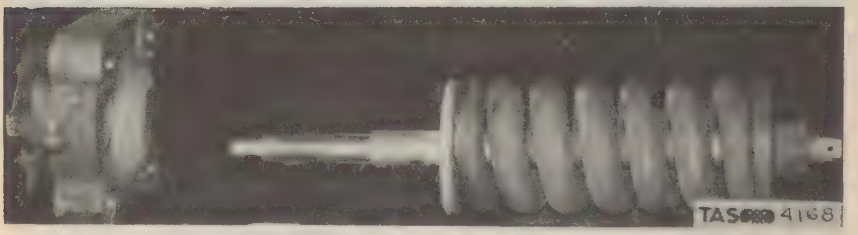


Figure 203. Controller Piston Rod Withdrawn from Box.

Figure 204. Removal of Piston Rod Packing.

Figure 205. Piston Rod Packing.

Figure 206. Disconnecting the Injector Assembly.

d. Injector assembly. To remove and replace the injector jet (nozzle) it is necessary to remove the entire injector assembly from the truck. The assembly is removed as follows:

(1) Uncouple the three (3) unions indicated in fugure 206.

(2) Remove the two (2) bolts beneath the platform

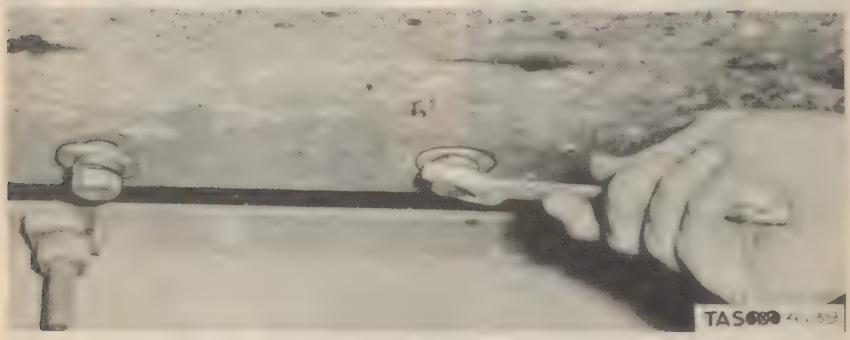


Figure 207. Removal of Injector Platform Bolts.

Figure 208. Loosening Injector Jet.

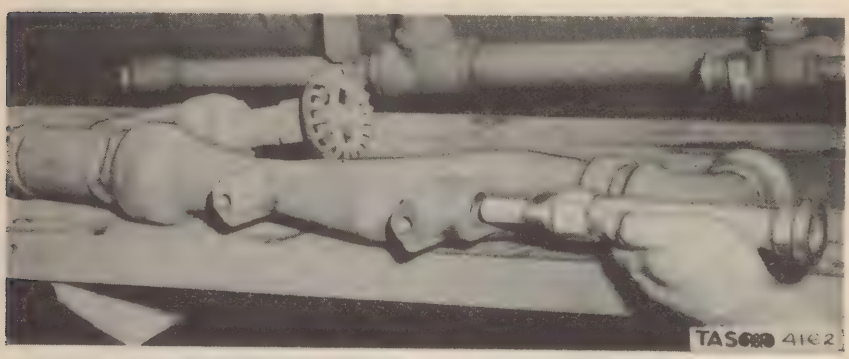


Figure 209. Removal of Injector Jet.

which hold the assembly in place.

(3) The injector jet may then be removed from the assembly. (Figs. 208 and 209)

e. Agitator paddles. Agitator paddles may break occasionally upon striking foreign objects in the bleach and will

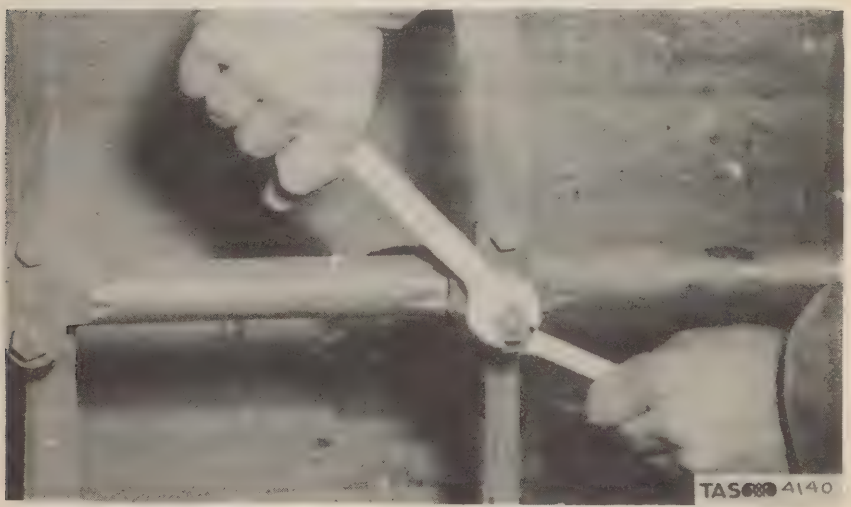


Figure 210. Replacing an Agitator Paddle.

require replacement in a manner indicated in figure 210.

f. Chains. See paragraph 34 g.

23. TROUBLE - COMMON CAUSES OF PRESSURE DROP.

a. Starting pump. The pump is self-priming. If it fails to prime within 10 seconds the trouble is probably due to one or more of the following causes:

(1) Sticking of the discharge or intake valve balls to the valve seats, or grit or dirt between the valve balls and seats. Remedy this by raising the suction valve balls off their seats with the valve ball lifters. If this does not correct the trouble, remove the valve assemblies and clean and replace.

(2) Air leak in the intake manifold or line.

(3) The pump may be air-bound. Remedy this by opening the tank return valve in order to flush the pump. Operate the pump until the liquid discharges through the overflow pipe into the tank. Then close the valve.

(4) Air leak through the valve lifters under the suction valves. Correct this by tightening the packing nut or replacing the packing if necessary.

b. Low pressure. Low pressure may be caused by any of the following:

(1) Improperly adjusted pressure controller.

(2) Badly worn valve balls or seats in either or both the pump or pressure controller.

(3) Grit or dirt between the valve balls and seat in

either or both the pump or pressure controller.

(4) Intake valves sticking.

(5) Air leak in the intake line.

(6) Clogged strainers.

(7) Too large a discharge orifice in the spray or washing guns.

(8) Insufficient speed developed by the truck engine.

Figure 211. The "Myers" M3A1 400-Gallon Power-Driven Decontaminating Apparatus.

SECTION IV

M3A1 - "MYERS"

24. DESCRIPTION. a. General. The "Myers" type apparatus employs its own distinctive pump and valve assembly. It can be identified by the valves, which are located on the left side of the pump housing. (Fig. 211) No other type of M3A1 apparatus has valves on the left side. The name-plate is also prominently displayed on the right side of the pump. (Fig. 214)

b. Pump assembly. The power end of the pump consists of a one-piece casting which forms the base of the pump and houses the gears, pinions, connecting links, crossheads, and bearings, and also forms the oil reservoir. (Fig. 214) The gear case lid is so located that it may be removed for inspection and servicing of the power end without removing the oil. Porcelain-lined steel cylinders with tapered joints are easily removed for inspection or replacement. The tapered stainless steel valve seats are forced into place, eliminating gaskets and preventing leakage. All parts, including plungers, are readily accessible for servicing.

c. Injector assembly. The injector is used for rapid filling from a pond or stream. Priming is not necessary when

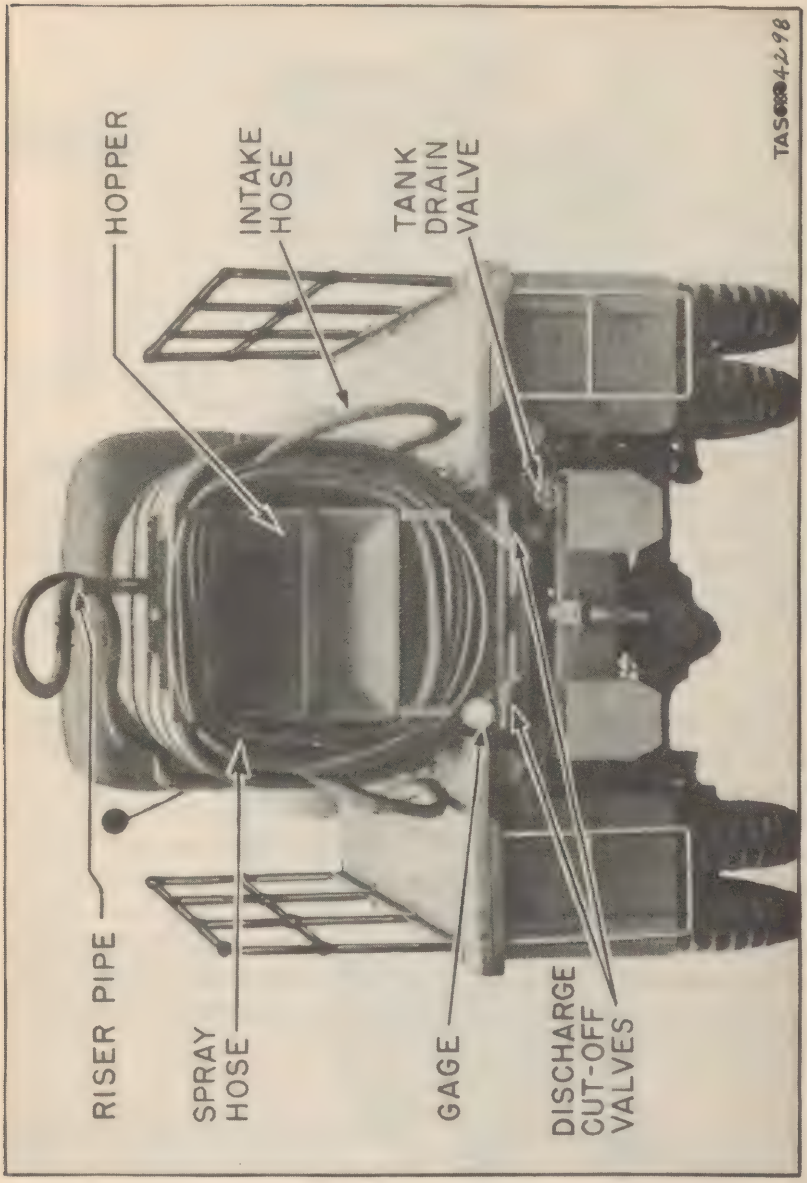


Figure 212. Rear View of the "Myers" M3A1.

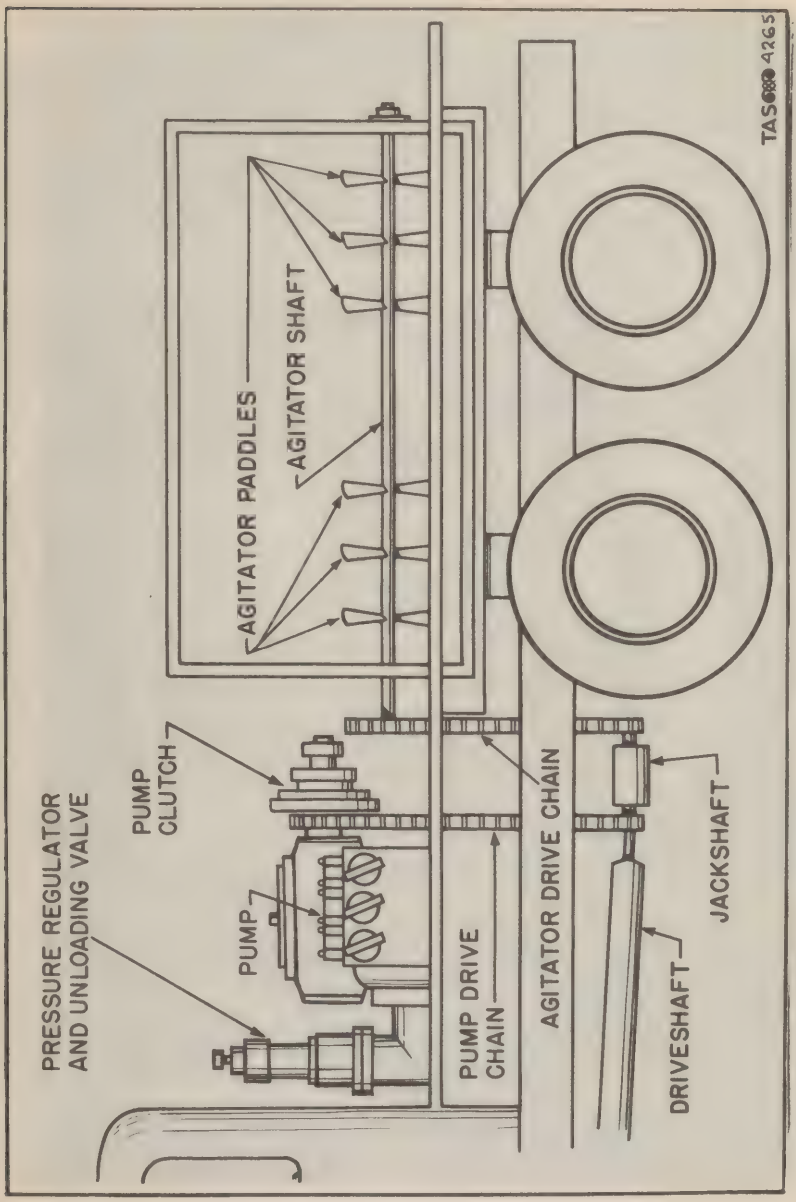


Figure 213. General Arrangement of Parts.

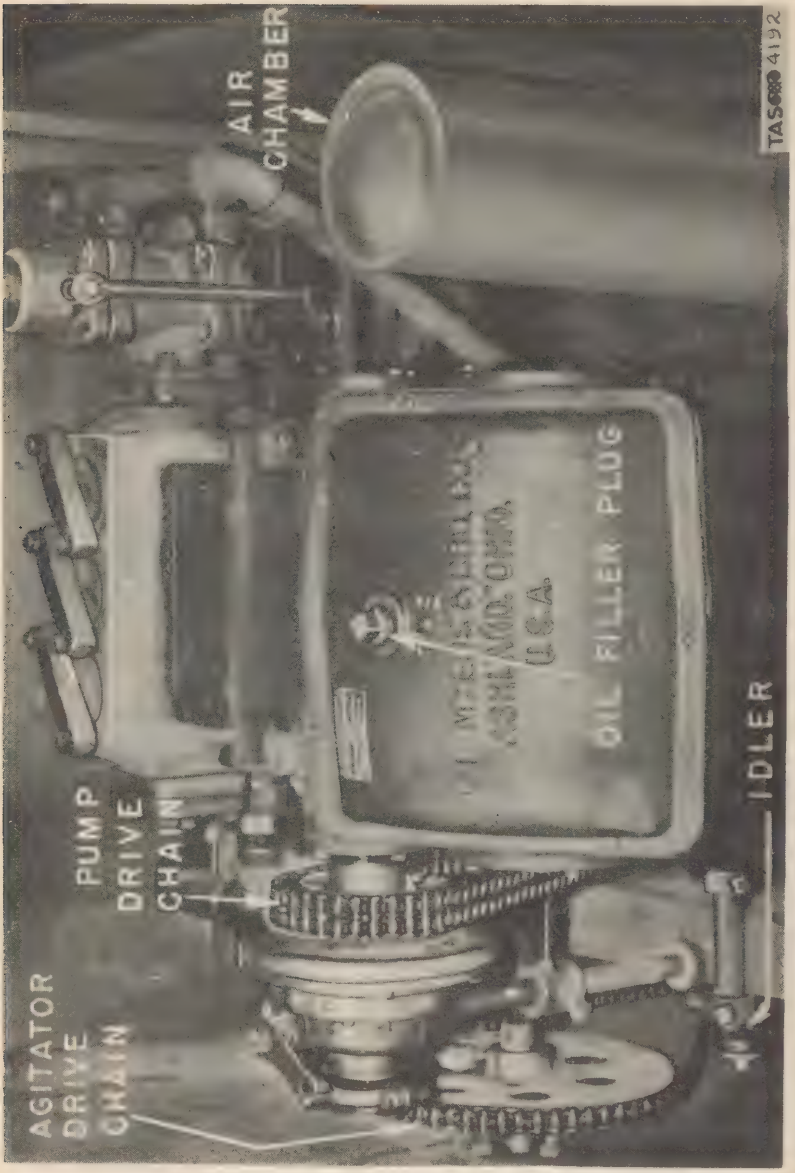


Figure 214. Oblique Right-Side View of Pump Assembly.

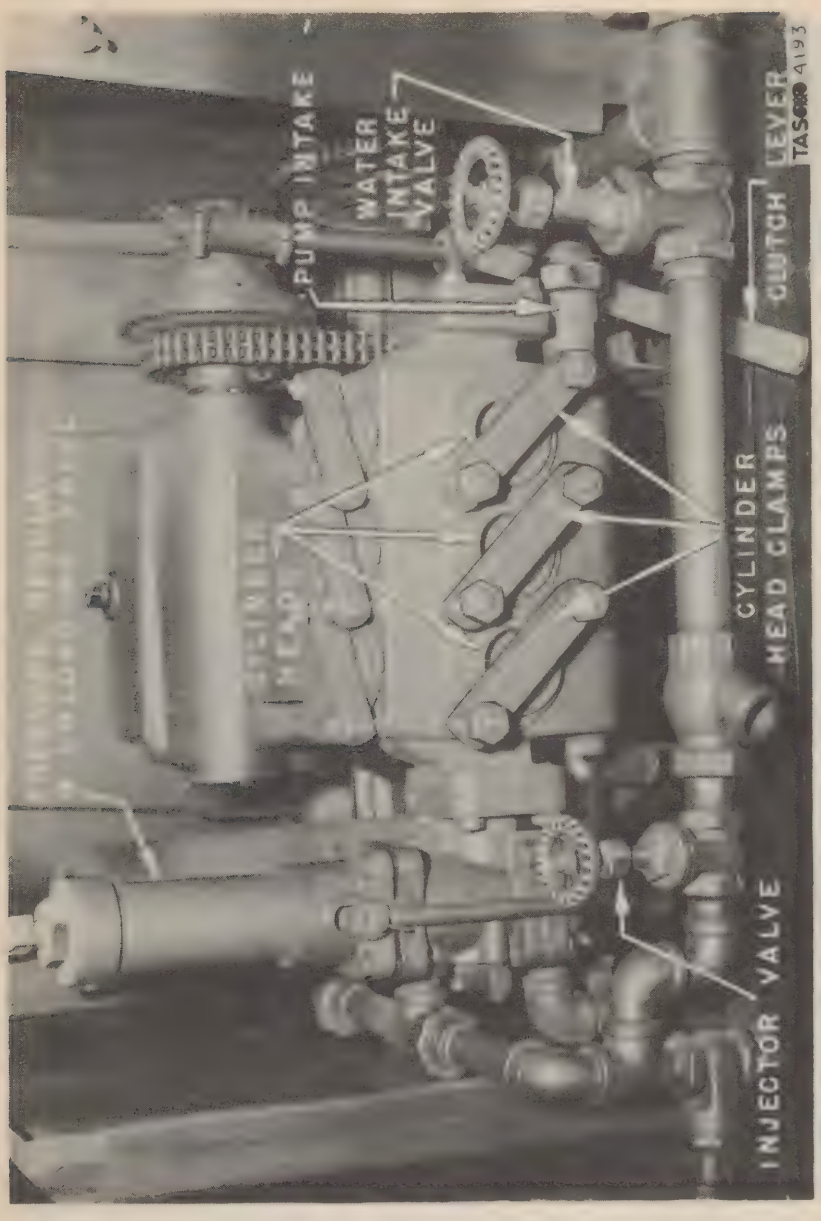


Figure 215. Oblique Left-Side View of Pump Assembly.

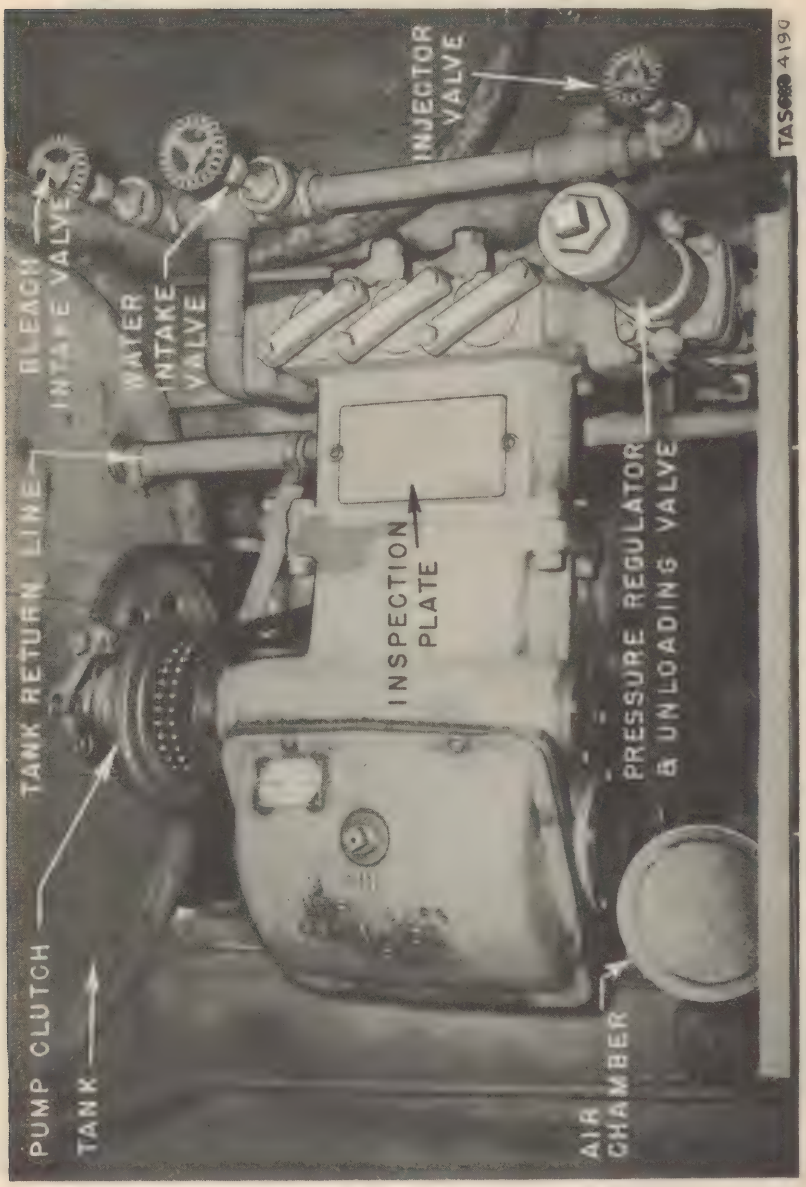


Figure 216. Pump Assembly as Seen from Top of Cab.

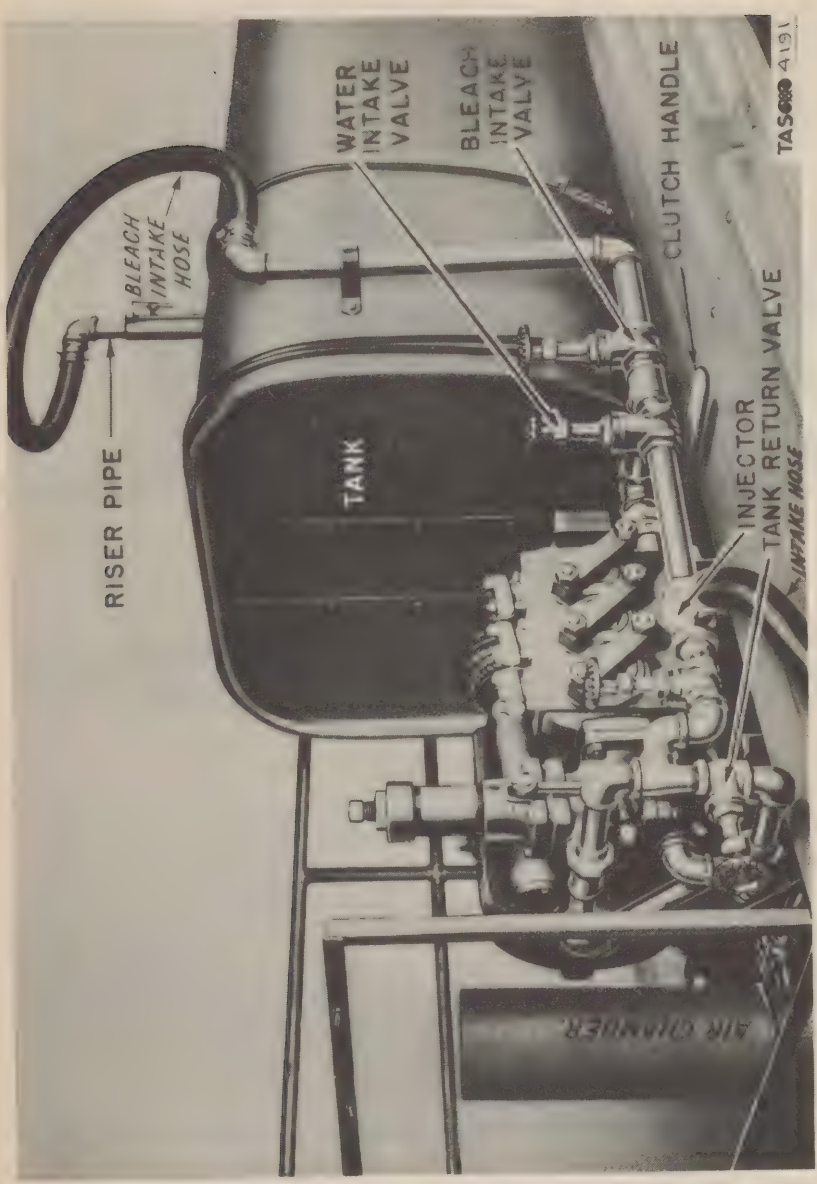


Figure 217. Three-Quarter View of Pump Assembly.

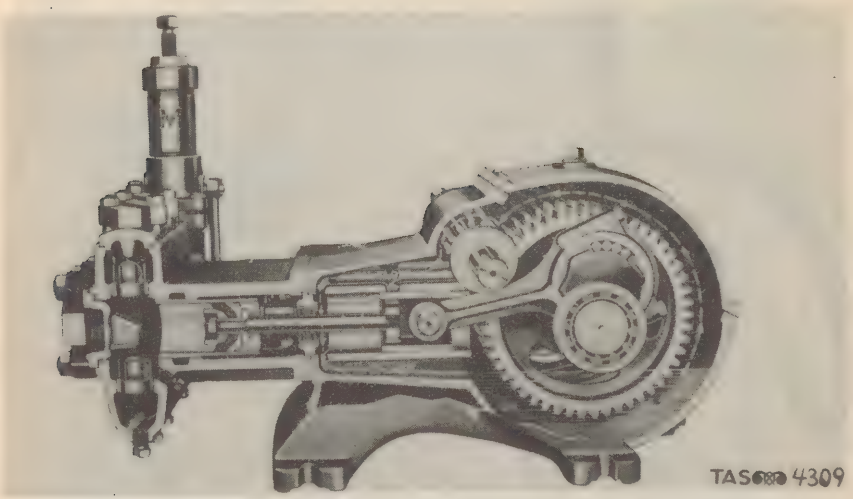


Figure 218. Cross Section of Pump.

there is enough water in the tank to cover the strainers. Otherwise, the pump must be primed. Water may be lifted upwards to 20 feet by use of the injector.

d. Pressure regulator and unloading valve. The purpose of this valve is to keep automatically the pump at proper pressure. It also acts as a "safety," taking care of excess pump capacity. While under pressure, liquid comes from the pump to the relief valve through an opening on one side, passes under the hydraulic plunger assembly, and on out to the discharge hose and spray guns. The tension of the spring of the pressure regulator controls the operating pressure (usually 400 pounds). If the pressure rises above this setting, it overcomes the spring tension and forces the plunger upward, thus raising the valve. This permits the excess pressure (liquid) to escape through the opening at the bottom of the regulator, through the overflow pipe, and back into the tank.

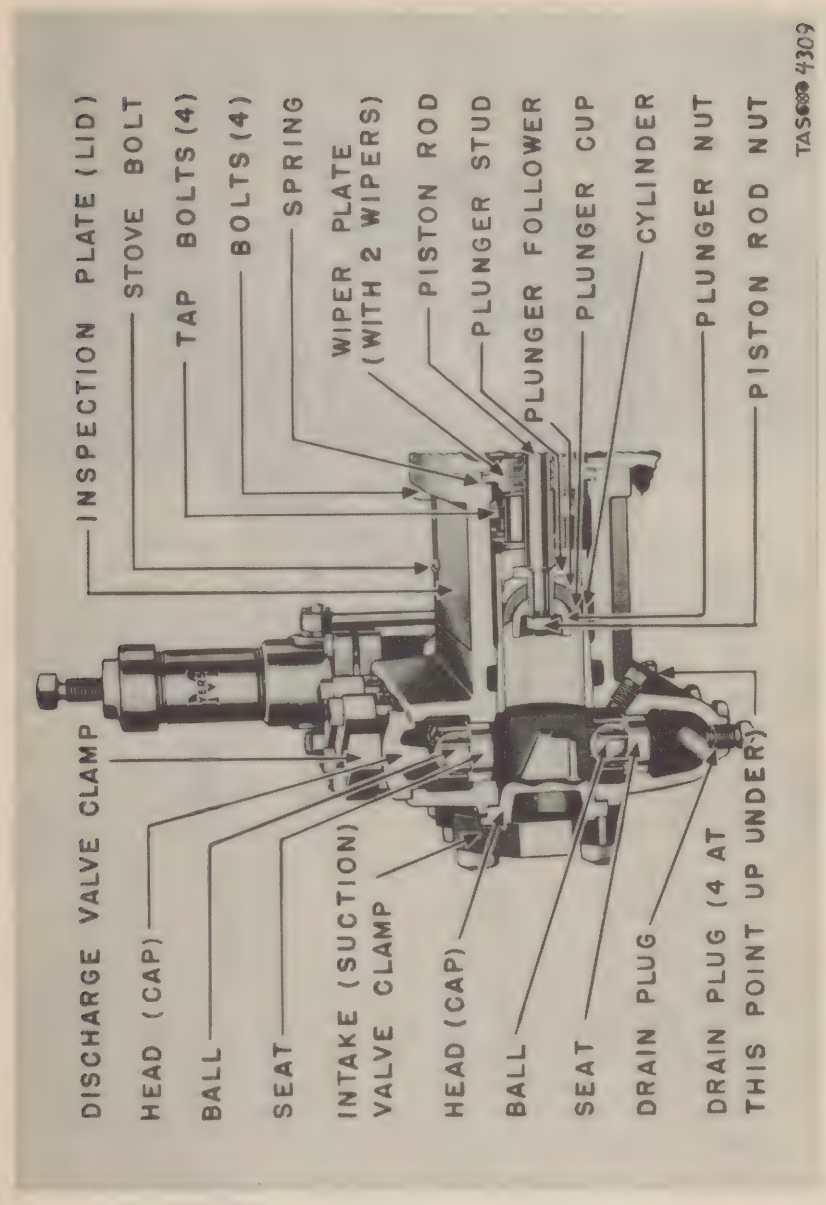


Figure 219. Cross Section of Valve Chambers and Cylinder.

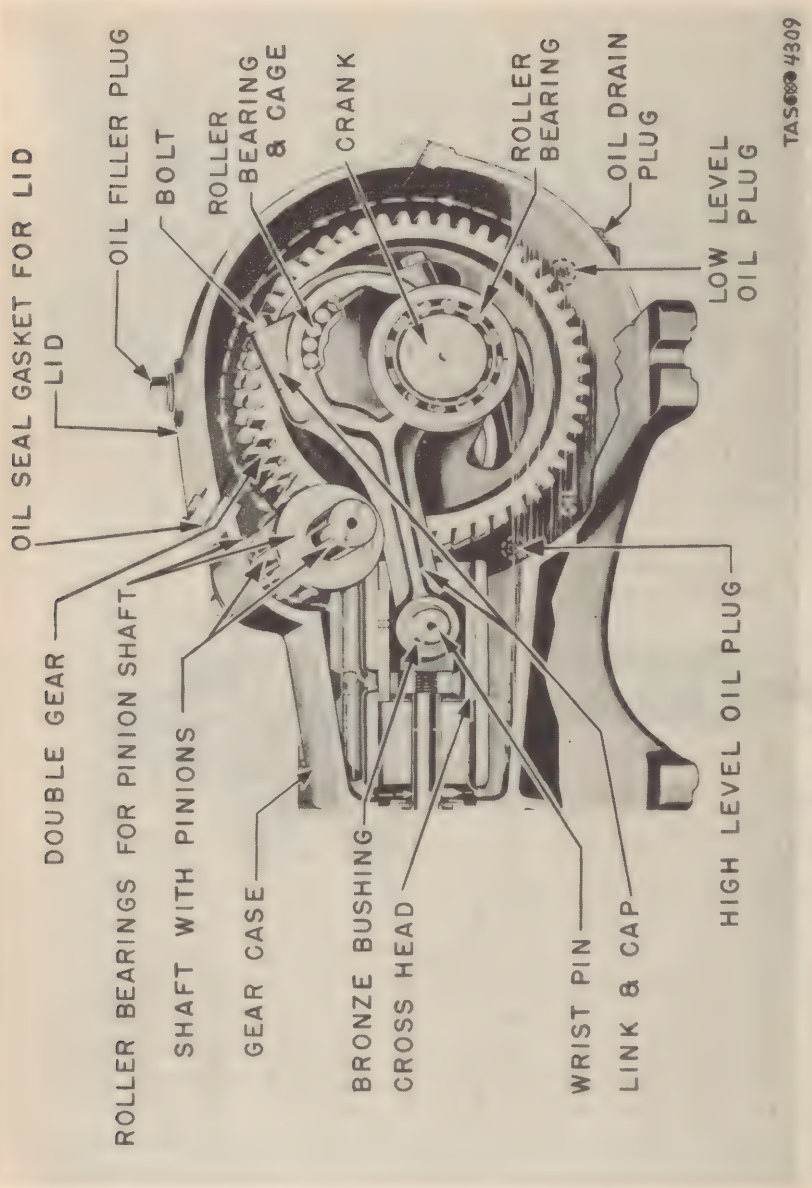


Figure 220. Cross Section of Gear Case.

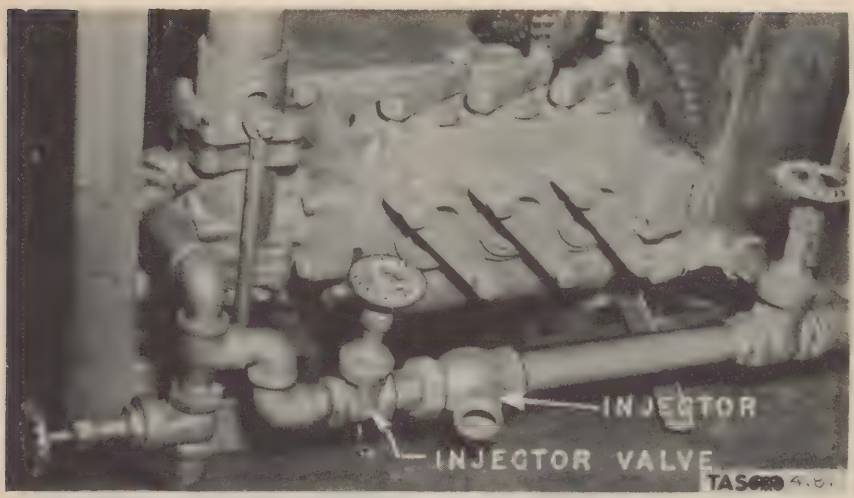


Figure 221. Injector Assembly.

e. Pump clutch. The pump clutch is mounted between the pump and the tank, and is operated by a handle placed to the left of the pump and just above the working platform. It is a flat disk-type and easily adjusted.

f. Tank. The tank is held together by four metal hoop bands. Four tighteners are provided on each side of the tank for adjusting the hoop bands.

g. Agitator. The agitator is connected directly to the power take-off by a roller chain and sprockets. The agitator drive is independent of the pump drive because there are many times the agitator must be kept running when it would be unnecessary and undesirable to operate the pump.

h. Valves. Valves are located at the left of the pump

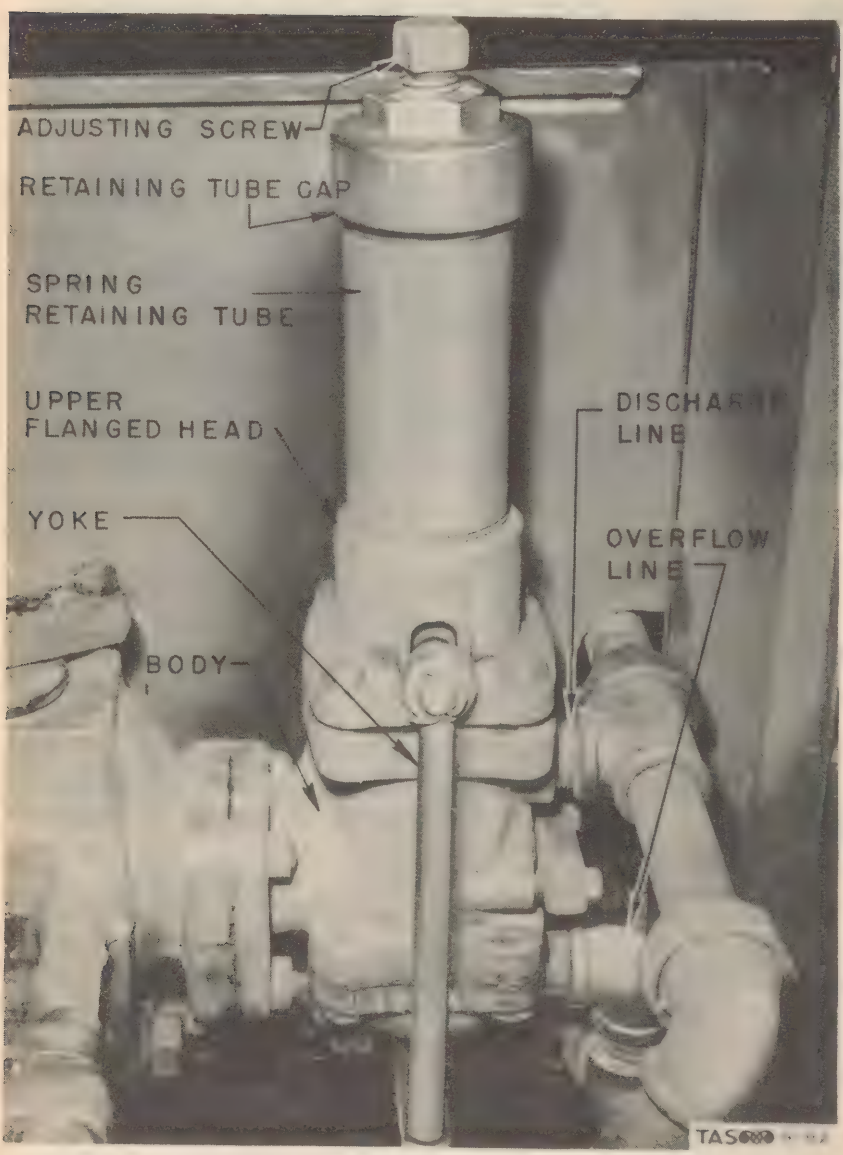


Figure 222. Pressure Regulator and Unloading Valve.

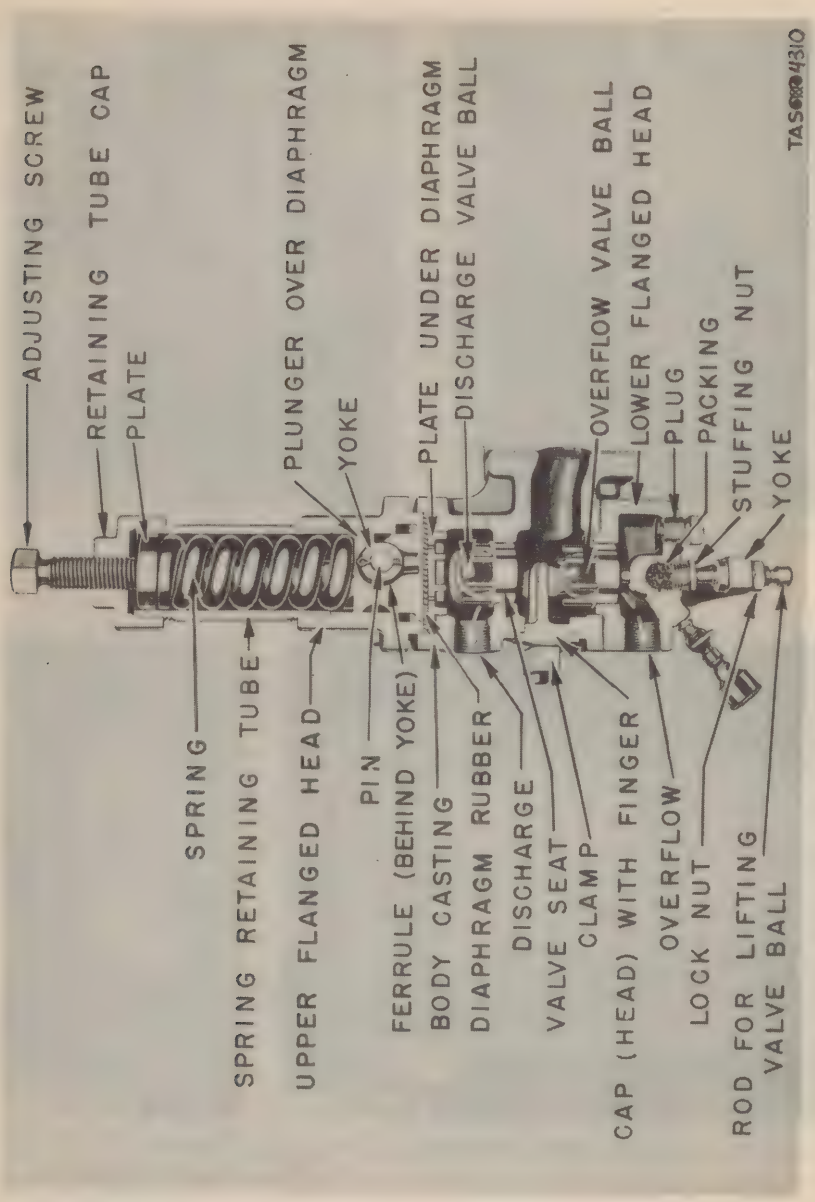


Figure 223. Parts of Pressure Regulator and Unloading Valve.

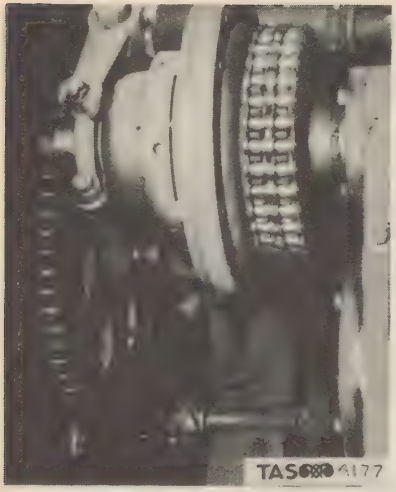


Figure 224. Pump Clutch.

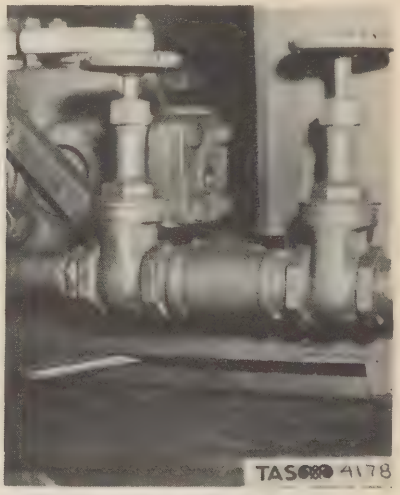


Figure 225. Pump Clutch Lever.

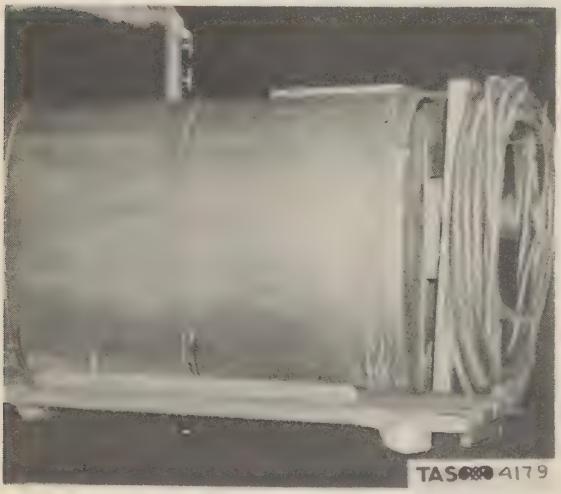


Figure 226. The Tank

Figure 227. Hoop Band Tightener.

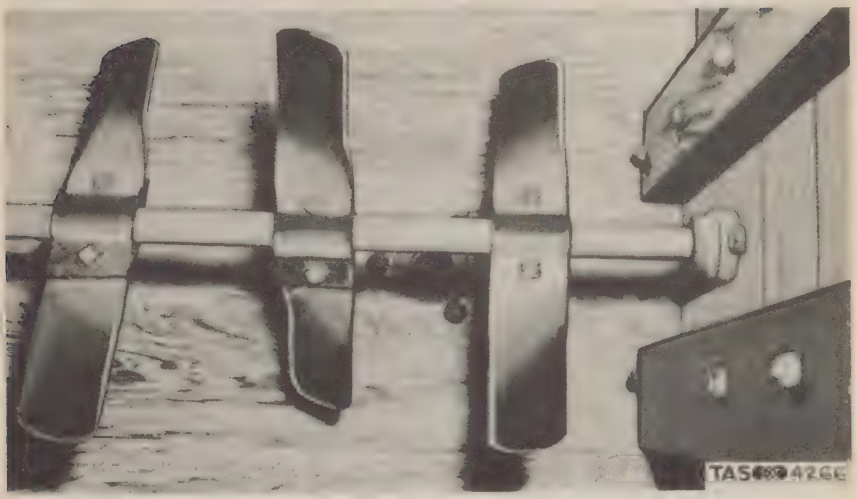


Figure 228. Partial View of Agitator Shaft and Paddles.

(fig. 217) and at the rear of the tank (fig. 212). It is important that valves be opened and closed strictly in the order given in the operating instructions. They must be entirely opened or closed because a blast of slurry passing under pressure through a half-opened valve will cause uneven wear of the valve parts. The water intake, bleach intake, and tank intake valves are gate valves, while others are the free-ball cut-off type which may require cleaning or replacement at times.

i. Washing gun. The washing gun is provided for cleaning the apparatus and is designed especially for cleaning the inside of the tank.

j. Spray guns. Spray guns are provided with Bordeaux type nozzles, and may be taken apart for cleaning and replacement of parts.

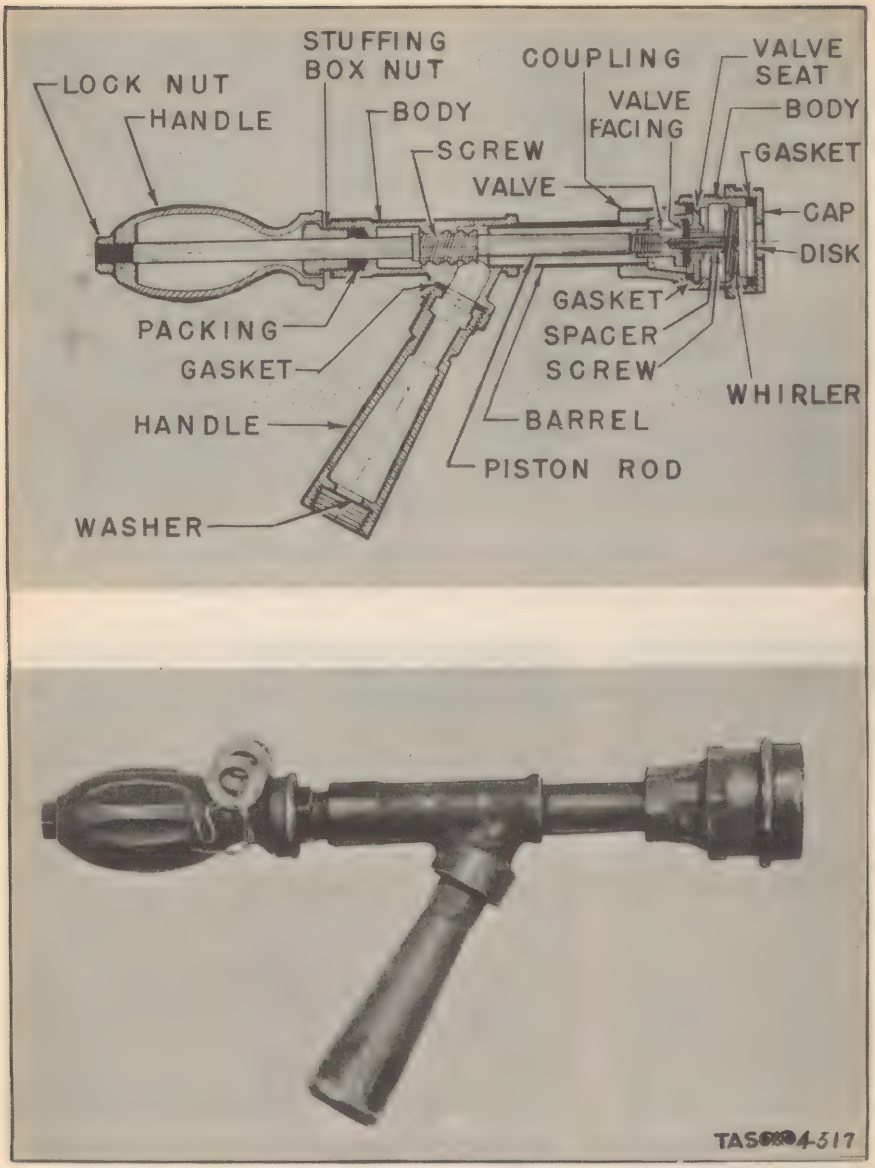


Figure 229. Washing Gun.

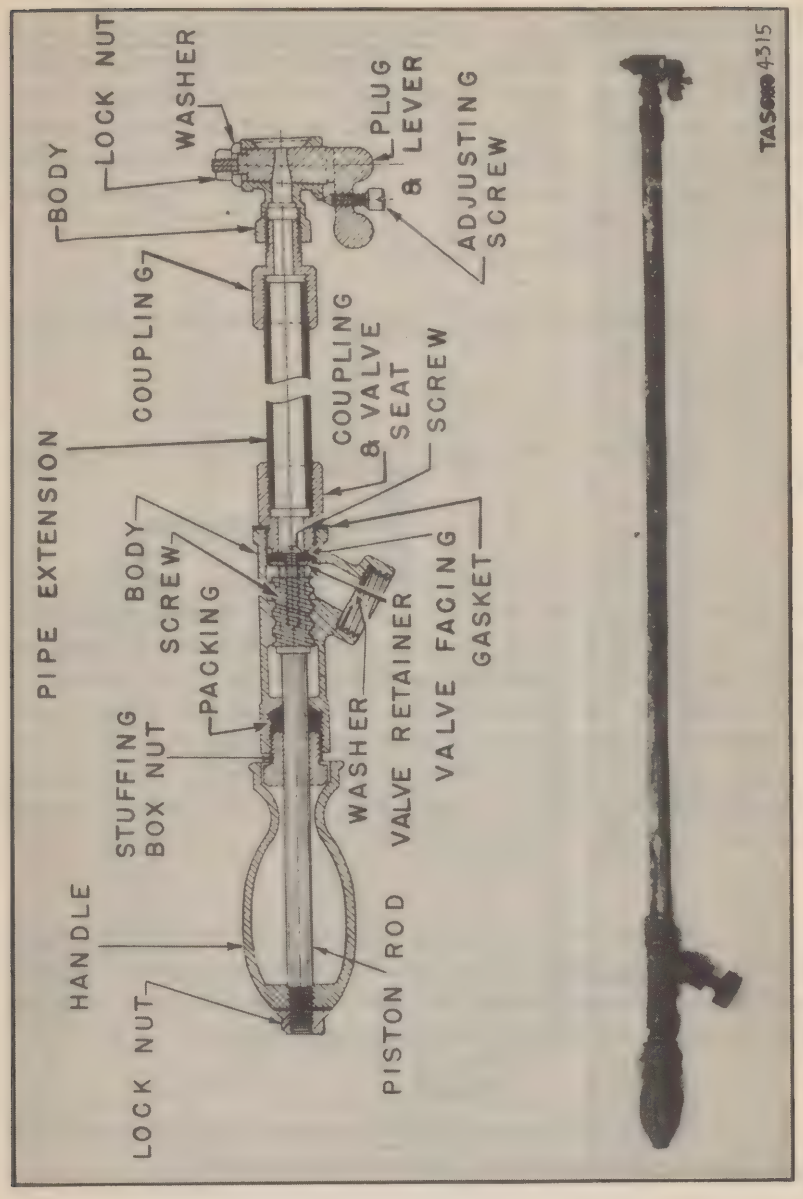


Figure 230. Spray Gun.

25. OPERATION. a. Loading water by priming pump with water in tank. This method can be used when there is enough water in the tank to prime the pump. Care must be taken to insure that the water in the tank covers the strainers on the end of the bleach intake pipe inside the tank. Then insert the strainer of the intake hose in a pond or stream. The remaining procedure is as follows:

(1) Open the bleach intake valve and the tank return valve.

(2) Close the water intake valve and the injector valve.

(3) Start the engine and engage the pump clutch. Next allow the pump to operate until it is primed and pumping water. The pump will prime quickest at low speed; therefore, idle the engine to reduce the pump speed just long enough to prime the pump. By listening to the valves it can be determined when water is being pumped. When there is no water in the pump the valves make very little sound. As soon as the pump starts discharging water, however, there will be a noticeable increase in the valve sound.

(4) When the pump is primed, open the water intake valve and close the bleach intake valve. Allow the pump to operate until air is pumped out of the hose and the pump is pumping water, as indicated by sound of the pump valves.

(5) Close the tank return valve and the pressure should rise to 400 pounds, if the pump is primed.

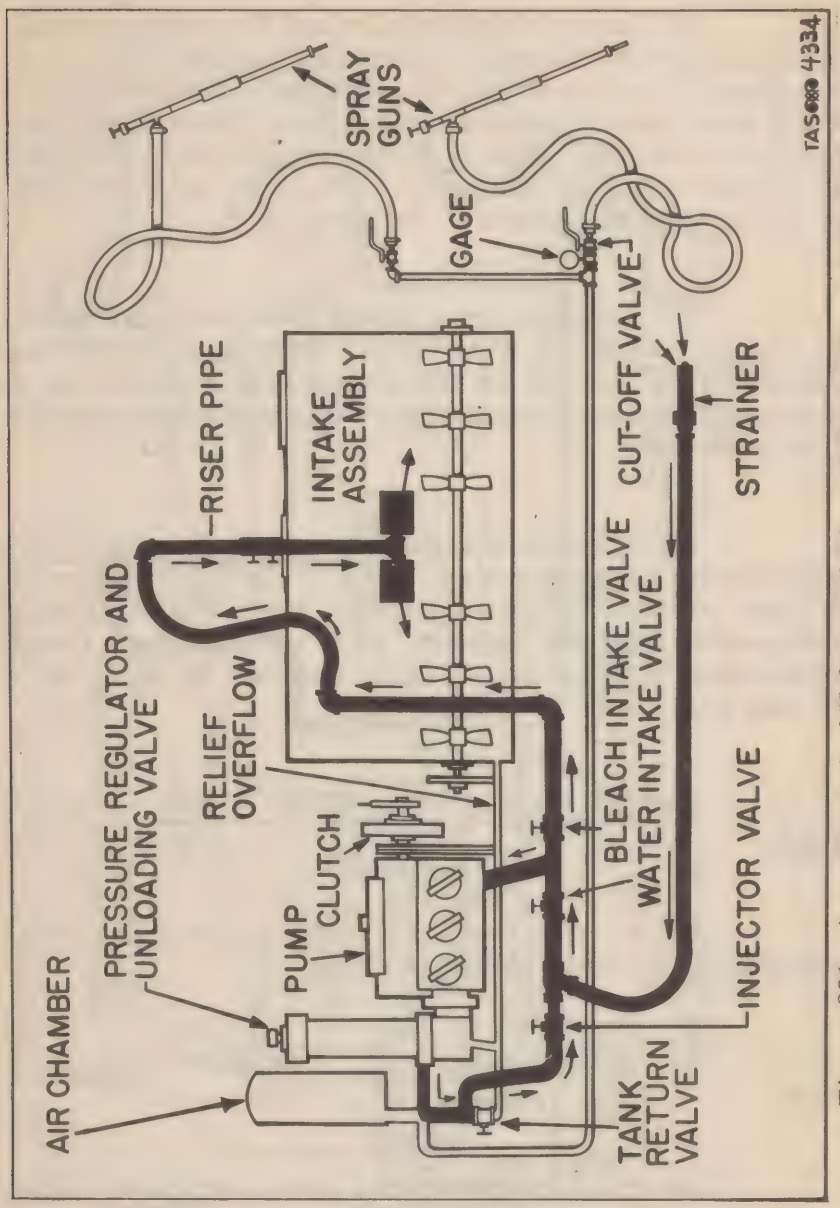


Figure 231. Arrangement of Valves and Flow of Water When Filling Tank.

(6) Open the injector valve and the pressure should not drop below 250 pounds. If it drops to 0 pounds the pump is not primed. Check for air leaks in pump and intake hose. Drain plugs, valve caps, cylinder caps, and insure that all hose connections are airtight. After everything has been checked, start all over again from the first step. In no case should the pump be operated dry longer than 10 seconds.

(7) If the pressure does stay above 250 pounds, open the bleach intake valve. Water will be discharged into the tank through the strainers on the end of the bleach intake pipe as it is drawn through the strainer at the water intake hose from the pond or stream.

(8) As soon as the tank is filled, close the water intake valve and the injector valve. Be sure the tank return valve remains closed. Then stop the pump. The intake hose can be disconnected from the injector. Make certain that the bleach intake valve is open so that the pump may take the liquid out of the tank when ready.

b. Loading water by using bucket of water to prime pump.

(1) Place the strainer of the intake hose into a bucket containing at least 5 gallons of water.

(2) Open the water intake valve and the tank return valve.

(3) Close the bleach intake valve and injector valve.

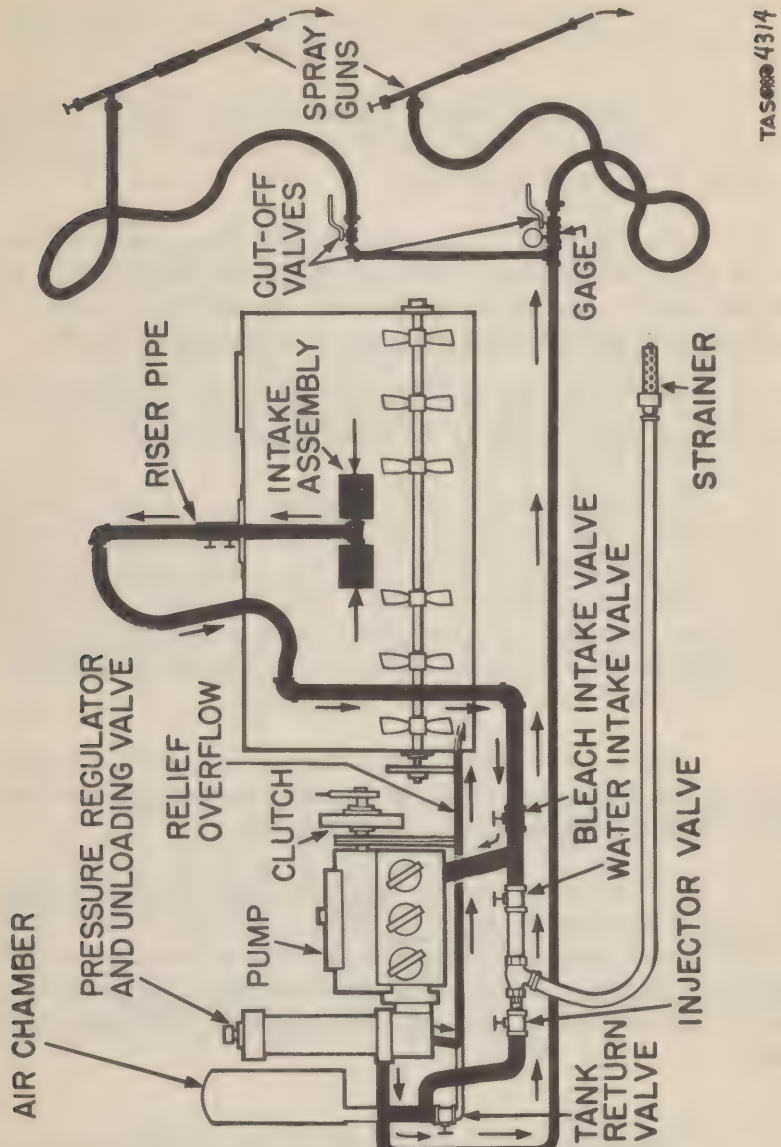


Figure 232. Arrangement of Valves and Flow of Liquid When Spraying.

(4) Start the engine and engage the pump clutch. Operate the pump at slow speed by throttling down the engine.

(5) When the water lowers in the bucket to a point near the top of the strainer, quickly transfer the strainer from the bucket to the pond or stream.

(6) Continue to operate at slow speed until certain that the pump is thoroughly primed; then open the throttle and allow the pump to run at normal speed. An increased sound in the valves will indicate that the pump is discharging water.

(7) Close the tank return valve and the pressure should rise to 400 pounds, if the pump is primed.

(8) Open the injector valve and the pressure should not drop below 250 pounds. If the pressure drops to 0 pounds the pump is not primed. Do not operate dry for more than 10 seconds. Check the pump and intake hose for leaks. The drain plugs, valve caps, and cylinder caps on the pump, and all hose connections, must be airtight. When everything has been checked, start all over again from the first step.

(9) If the pressure stays above 250 pounds, open the bleach intake valve and water will be discharged into the tank through the bleach intake pipe and strainers.

(10) As soon as the tank has been filled, close the water intake valve and the injector valve. The tank return valve remains closed. Stop the pump and the intake hose can be disconnected from the injector. Be sure the bleach intake valve is open so that the pump can take the liquid out of the tank when ready.

c. Pumping water without filling tank. Water may be

pumped directly from a stream without first filling the tank. This method may be used when washing contaminated vehicles. The procedure is as follows: Prime the pump, close the tank return valve and open the discharge cut-off valves. The resulting flow of water from the pump may be controlled by the spray gun valves.

d. Loading bleach. See paragraph 6 c.

e. Spraying. The strainers, or screens, at the end of the bleach intake pipe may be lowered into the liquid in the tank only when ready for spraying and while spraying. When ready to discharge from guns, close the water intake valve, tank return valve, and injector valve, and open the bleach intake valve. The shut-off valves at the tank end of each length of discharge hose must be opened before liquid will reach the guns. Both of these shut-off valves must be closed again when spraying is completed. Be sure the strainers at the end of the bleach intake pipe are lowered into the liquid only while spraying and are immediately withdrawn to a position near the top of the tank when spraying is completed.

26. TOOLS AND SPARE PARTS. a. Repair kit. The repair kit is a large box on the left side of the truck and contains grease, oil, shovels, brooms, scrub brush, and a tool box. The kit is similar to that shown in figure 48.

b. Tool box. Tools and smaller replacement parts are kept in the tool box. (See figs. 233 - 237)

c. Spare equipment chest. Other spare parts are kept in the spare equipment chest. (See figs. 238-240.)

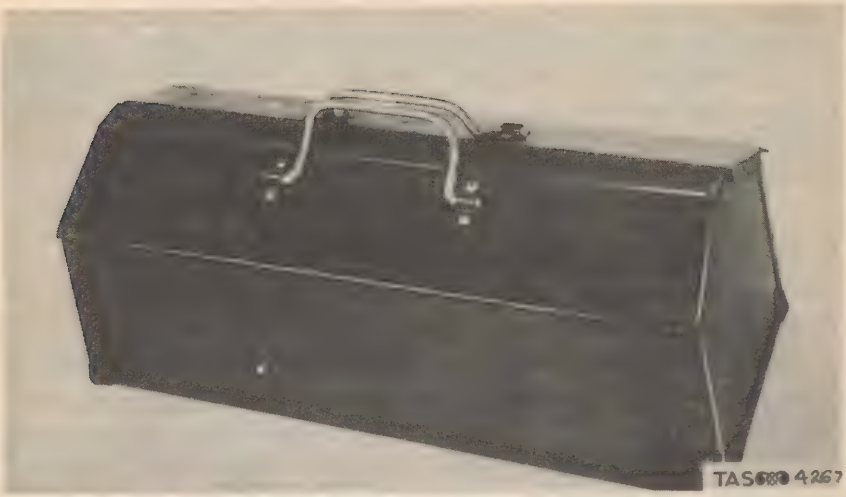


Figure 233. Tool Box.

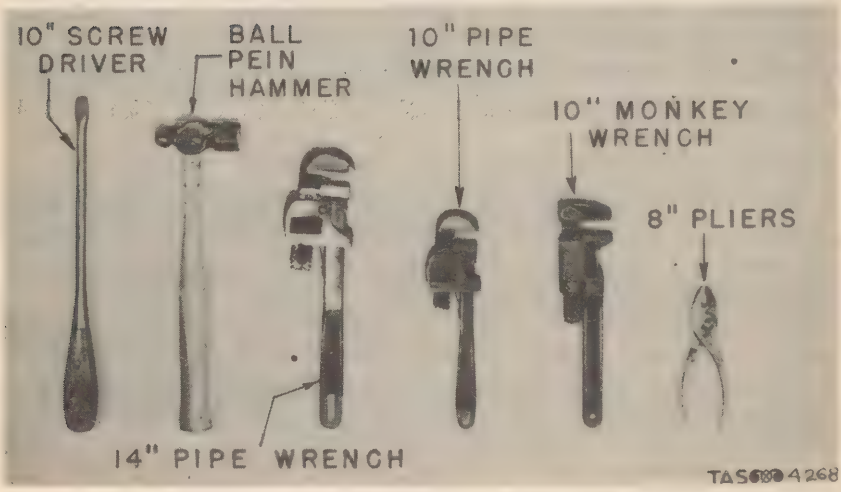


Figure 234. Common Tools in Tool Box.

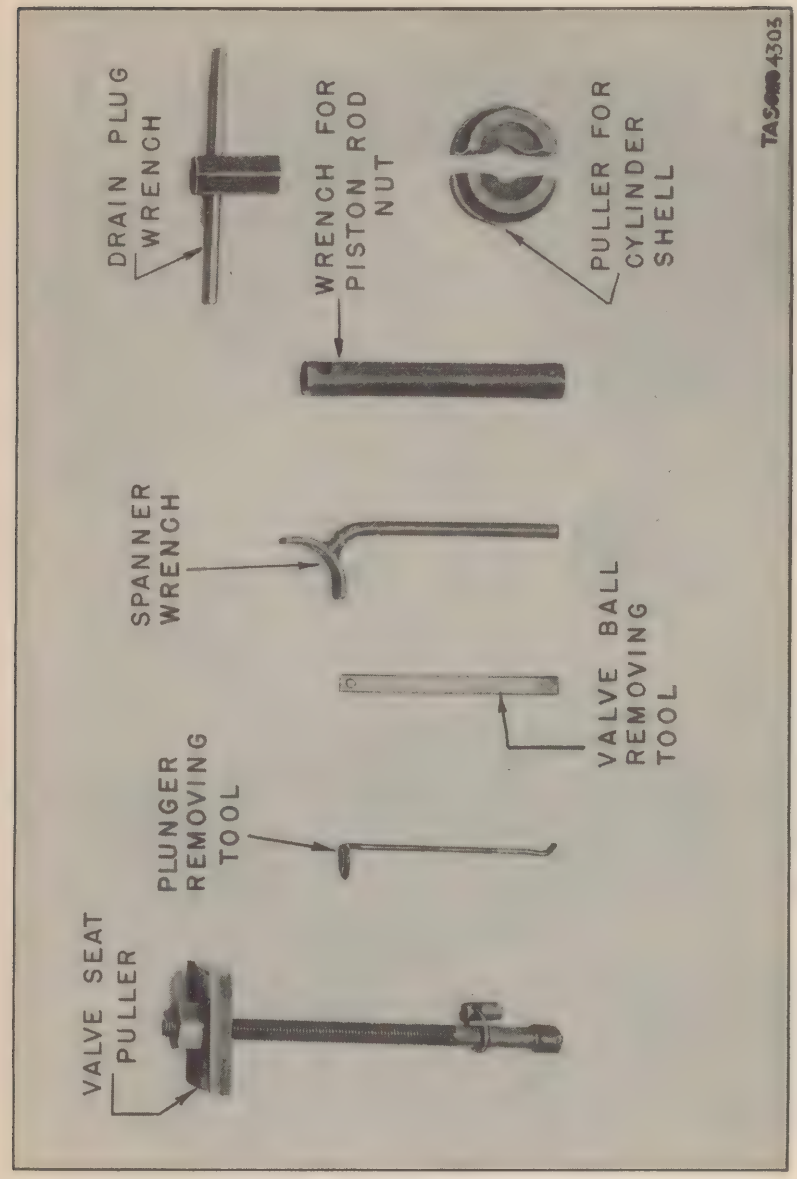


Figure 235. Other Tools in Tool Box.

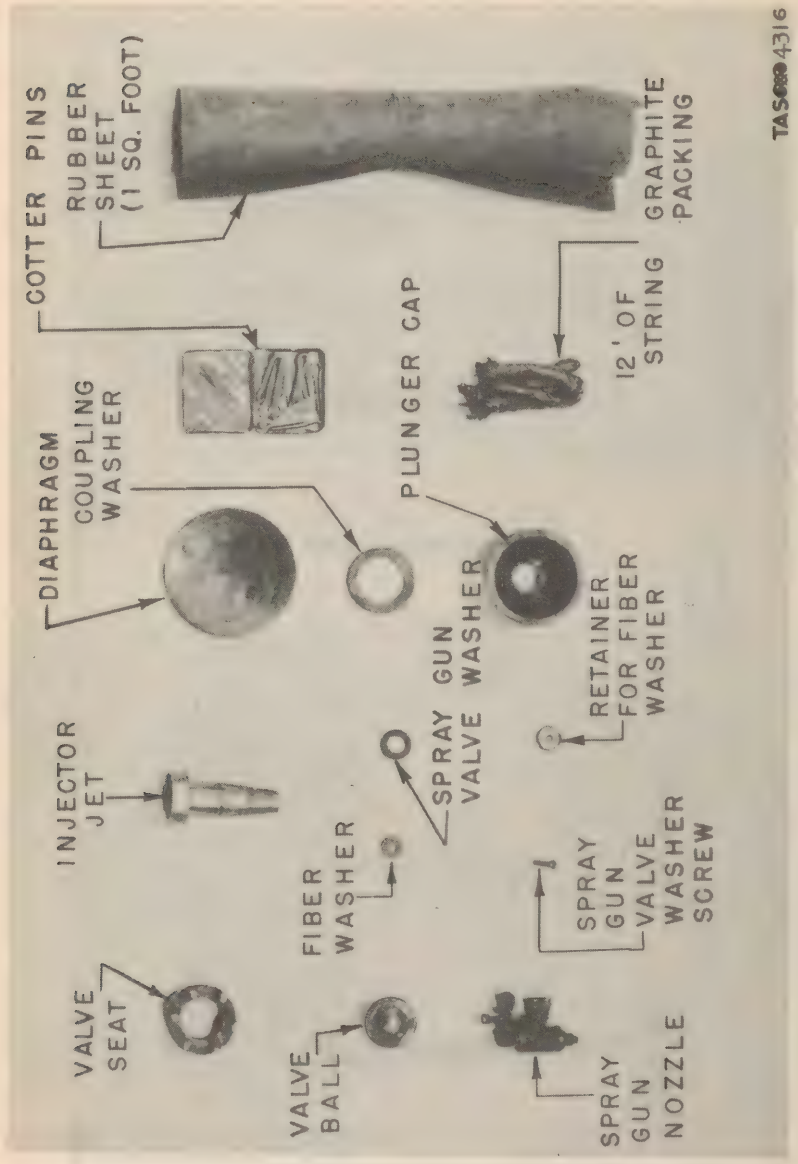


Figure 236. Spare Parts in Tool Box (1).

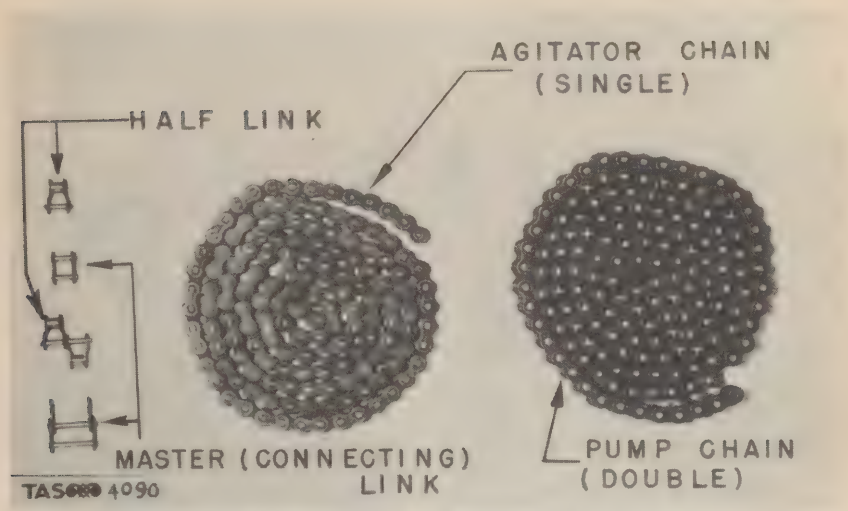


Figure 237. Spare Parts in Tool Box (2).

Figure 238. Spare Equipment Chest.

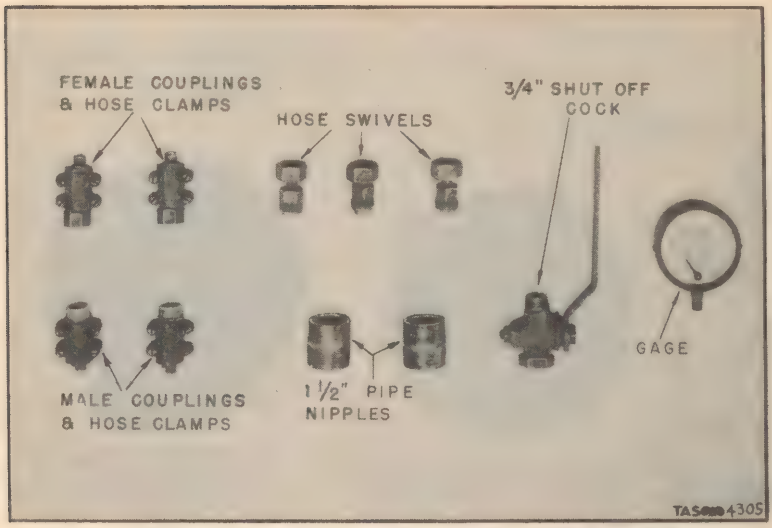


Figure 239. Contents of Spare Equipment Chest (1).

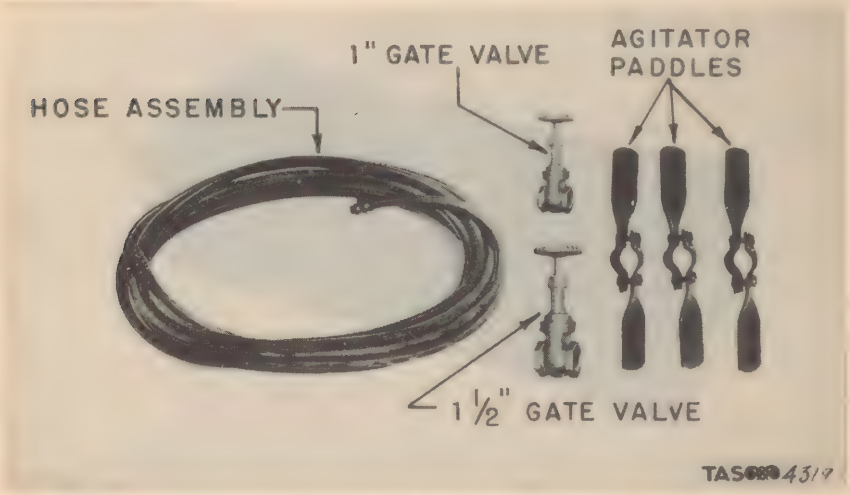


Figure 240. Contents of Spare Equipment Chest (2).

27. SIMPLE MAINTENANCE. a. Lubrication. The following instructions must be carefully observed:

(1) Pump. Before starting the pump, fill the crankcase with a good grade of automobile engine oil, No. 20 or No. 30 S.A.E. specification. The oil level should be maintained not higher than the upper 1/4-inch pipe plug, nor lower than the lower 1/4-inch pipe plug, both of which are found on the side of

Figure 241. Oil Filler Plug.

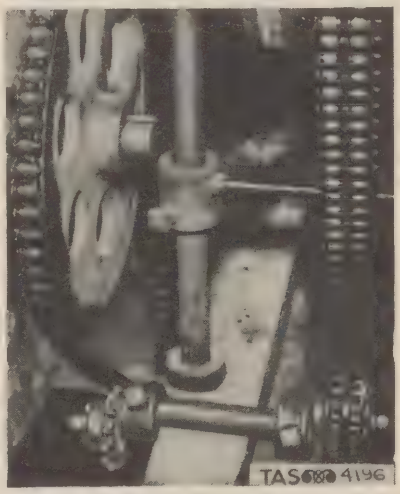


Figure 242. Chains and Tightener Sprockets.

the crankcase. (Fig. 220) In a new pump the oil should be changed after the first 60 hours of operation. Thereafter the oil should be changed after every 300 hours of operation. The old oil is drained from the crankcase at the 3/4-inch pipe plug at the bottom of the case, and new oil poured in at the 1-inch pipe plug located in the top of the lid. (Fig. 241). (Caution: When inspecting oil, and the oil is found to have a gray streak, change it immediately.)

(2) Chain drives. The chain drives must be oiled frequently. Proper care will increase the useful life of chains and sprockets. Use a good quality of oil, either S.A.E. No. 20 or No. 30, and apply with either an oil can or brush to the chains. For best results the oil should be applied to the inside of the chains just before they mesh with sprockets. Drip or brush the oil near the sideplates of the single-strand chain and on the centerplate of the double-strand chain. Do this every 4 hours of operation, or when not operated for 4 hours, once each day. After every 200 hours of operation chains should be removed and cleaned thoroughly with kerosene. After cleaning, submerge them in a pan of clean oil. The important thing is to keep chains free of dirt and abrasive particles and keep them well lubricated. The chain-tightener sprockets are each fitted with grease fittings which require greasing every 10 hours of operation. (Fig. 242)

(3) Clutch. There are two grease fittings in the clutch housing which require a small amount of lubricant once each day. The lubricant should be a high-grade, soda-base, short-fibre grease gun lubricant. (Fig. 243)

(4) Agitator. The only parts of the agitator requiring lubrication are the two packing boxes located at the ends of the tank. To keep the packing in good condition, grease should be forced in through the grease fittings once each day the sprayer is operated. (Fig. 252)

(5) Pressure regulator and unloading valve. The fitting shown in figure 244 should receive grease each day the apparatus is used.

(6) Other points. Apply gear oil to the universals (three fittings) when lubricating the chassis. The jack-shaft has grease-packed ball bearings and requires no attention. Shut-off valves should be disassembled after each day of use and grease applied to the inside parts to protect against corrosion. When

Figure 243. Grease Points on Clutch.

Figure 244. Grease Fitting on Pressure Regulator and Unloading Valve.

parts of the pump are reassembled grease should be placed on the threads.

b. Cleaning and drainage. All water must be drained from the pump, pressure regulator and unloading valve, pipes, tank, and hose whenever there is any likelihood of the temperature falling below the freezing point. A temperature of only a few degrees below freezing will crack the block of an undrained pump. In freezing weather the apparatus should be drained when spraying is completed for the day. After draining, it should be completely flushed with 100 gallons of water. If that is not enough, run 50 to 100 gallons more water in the tank and completely flush again. Constant care is absolutely necessary to keep the equipment in good operating condition. The following steps are necessary for proper drainage:

(1) Open the bleach intake valve. This valve is on

the left side of the pump near the front end of the tank. When facing the pump, it is the last valve to the right. (Fig. 217)

(2) Open the tank drain, controlled by a valve at the lower center rear of the tank. (Fig. 212)

(3) Run the pump long enough to force out water. This operation usually expels most of the water but cannot be relied upon for complete drainage. In no event should the pump be run dry for more than 10 seconds.

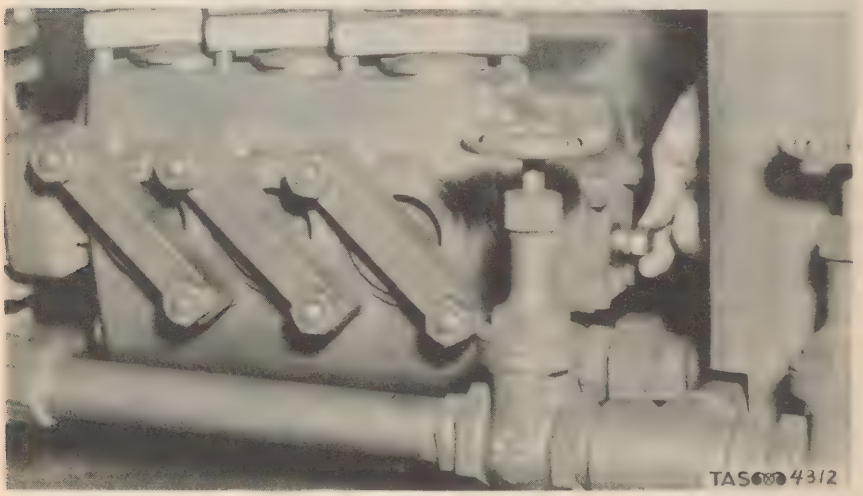


Figure 245. Removal of Drain Plug.

(4) Remove three drain plugs from the underside of the intake (suction) valve chambers. (Fig 219) These plugs are located at the lowest part of the pump and are reached from the left side of the truck. (NOTE: Four similar drain plugs are located behind the drain plugs just described and under the front end of the cylinders, but are difficult to reach and need not be removed if the instructions here given are followed.)

(5) Remove the drain plug near the corner of the right end of the pump, as seen from the valve side of the apparatus. (Fig. 245)

(6) Remove the three side cylinder heads (caps). (Fig. 253)

(7) Loosen the three top cylinder heads. (Fig. 260)

Figure 246. Lifting Upper Ball.

Figure 247. Lifting Lower Ball.

(8) Insert the fingers through the side cylinder head openings and raise the upper balls. (Fig. 246)

(9) Using the special tool inserted through the side cylinder head openings, raise the lower balls. (Fig. 247)

(10) Remove the drain plug at the bottom of the pressure regulator and unloading valve. (Fig. 248)

(11) Remove the cylinder head (cap) on the pressure regulator and unloading valve. (Fig. 249)

(12) Raise the upper ball of the pressure regulator and unloading valve with the fingers inserted through the cylinder head opening.

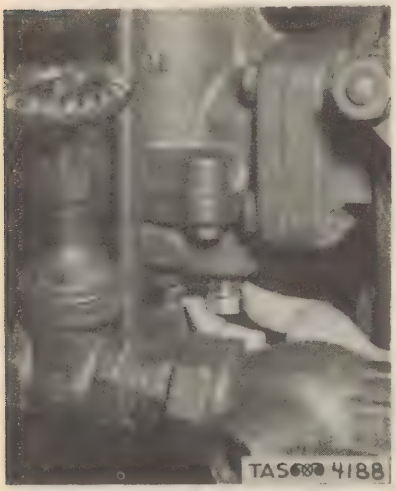


Figure 248. Removal of Drain Plug at Bottom of Pressure Regulator and Unloading Valve.

Figure 249. Removal of Cylinder Head on Pressure Regulator and Unloading Valve.

(13) Raise the lower ball of the pressure and unloading valve with the special lifting tool provided with each apparatus. (Fig. 279)

(14) Open the water intake valve. This is on the left side of the pump, and when facing the pump is seen as the second valve from the right. (Fig. 217)

(15) Open the injector valve, which is the second valve

from the cab on the left side. (Fig. 217)

(16) Open the tank return valve. This is the valve nearest to the cab on the left side of the pump. (Fig. 217)

(17) Open the two discharge cut-off valves located at the lower rear of the tank. (Fig. 212)

(18) Drain the two spray hose and guns by uncoiling the hose and opening the spray gun valves.

(19) Check and replace tightly all drain plugs and cylinder heads.

28. ADJUSTMENTS. a. Pressure regulator and unloading valve. Adjust the pressure by turning the adjusting screw, at the top of the pressure regulator and unloading valve, while the pump is operating and the spray guns closed, at the same time watching the pressure gage to see when the desired pressure is reached. To stop a chattering noise made by the pressure regulator, first check the packing on the plunger stem. It is important that this packing box be kept filled with a good grade of packing. If the chattering continues it will be necessary to make a complete readjustment as follows:

(1) Make certain that the pump is stopped.

(2) Loosen the adjusting screw.

(3) Turn the screw down by hand as tightly as possible; then make two additional complete turns with the wrench.

(4) Remove the truss clamp and unloading valve head (cap), and open the hole in front to give access to the valve ball. (Fig. 223)

(5) Loosen the lock nut and turn the rod for lifting

the valve ball upward until it touches the unloading valve ball. One finger should be inserted and placed on the unloading valve ball to determine exactly when the plunger stem touches the ball.

(6) When the plunger stem is just touching the ball, turn the plunger stem back or downward 1/4 turn.

(7) Tighten the lock nut.

Figure 250. Adjusting the Pressure Regulator.

Figure 251. Adjusting the Pump Clutch.

(8) Replace the unloading valve cap and truss clamp. Make certain that the truss clamp is absolutely tight. (NOTE: Whenever liquid is seen on the rod at the bottom of the regulator, tighten the packing nut located at the point where the rod goes into the regulator. Fig. 223.)

b. Pump clutch. If the clutch slips or heats, it must be adjusted. To adjust, turn the clutch until the adjusting lock pin can be reached. Pull this pin out and turn the adjusting yoke to the right, (clockwise), (fig. 251) until the operating lever requires a distinct pressure to engage. A new clutch usually requires several adjustments until the friction surfaces are worn in.

c. Agitator shaft packing. The packing nut on the end of the agitator shaft must be kept tight enough to prevent play and leakage. (Fig. 252)

d. Chain idlers (tighteners). When chains are too tight

Figure 252. Agitator Shaft Packing.

rapid wear is caused. If chains are too loose they will climb the sprockets. Keep the chains adjusted at 1/2-inch to 1-inch slack, as illustrated. (Fig. 82) The chains are tightened by loosening the idler sprocket, (fig. 242) moving it toward the chain and tightening. Sprockets must be kept in proper alinement. Check with a straight edge if the teeth of the sprockets show signs of wear on one side.

29. REMOVAL AND REPLACEMENT OF PARTS. a. Plunger assembly. It is frequently necessary to remove the plunger assembly for cleaning or replacement of packing. This operation is performed as follows:

(1) Remove the side cylinder heads (caps).

(2) Rotate the pump so that the plunger is at the closest point.

Figure 253. Removing Side Cylinder Head.

Figure 254. Piston Rod Nuts.

(3) With socket wrench, remove the piston rod nut which holds the plunger in place.

(4) Rotate the pump so that the piston rod will back out of the plunger casting.

(5) Insert the hooked tool, as shown in figure 255.

(6) Further rotate the pump so that the piston will push the plunger out.

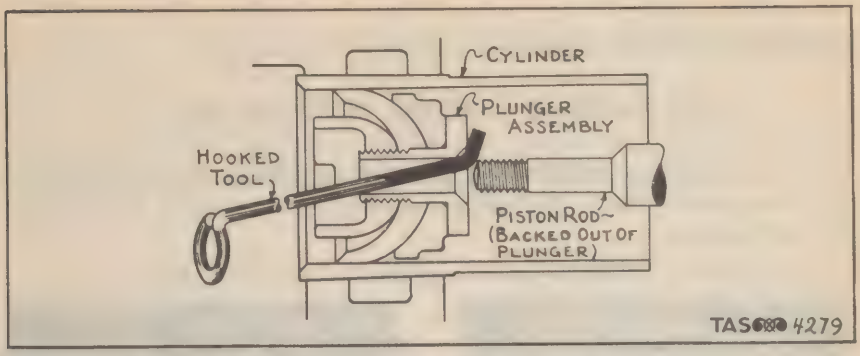


Figure 255. Removal of Plunger Assembly.

(7) Disassemble the plunger packing (cup) assembly, as illustrated in figures 256, 257, and 258.

(8) Clean the porcelain cylinder walls, taking care not to damage the porcelain. Clean off the accumulated hard deposit of bleach at each end of the plunger stroke in the cylinder. (A new packing (cup) would undergo severe strain if rub-

Figure 256. Removal of Plunger Nut.

Figure 257. Removal of Plunger Cup.

bed against such a deposit.)

(9) Carefully clean and oil the cup nut.

(10) Install the new plunger packing (nut) and assemble reasonably tight. It is not necessary or desirable to assemble too tightly.

Figure 258. Removal of Plunger Follower.

Figure 259. Replacement of Plunger Assembly.

(11) A little light oil or grease placed on the edge of the packing will make it easier to insert in the cylinder.

(12) Put the plunger assembly back into the cylinder. (It may be driven back with a few taps of a hammer. Fig. 259)

(13) Rotate the pump so that the piston rod comes through the packing, thus enabling you to:

(a) Replace the piston rod nut, tightening it with the socket wrench; and,

(b) Replace the cylinder head, clamps, and nuts.

b. Valve assembly. It will be necessary from time to time to remove the valve balls and seats for replacement of worn parts or for cleaning. This operation is performed as follows:

(1) Remove both side and top cylinder heads (caps). (Figs. 253 and 260)

Figure 260. Removal of Top Cylinder Heads.

Figure 261. Valve Seat Puller in Place.

(2) Remove the lower balls with the special tool. (Fig. 247)

(3) Remove the upper balls by inserting a finger in the side cylinder head and pushing the balls within reach from the top cylinder head. (Fig. 246)

(4) Insert the head of the valve seat puller all the way through the hole in the valve seat.

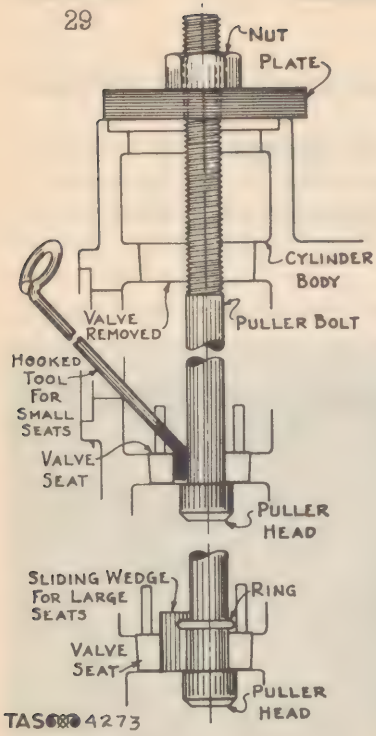


Figure 262. Valve Seat Puller and Hooked Tool.

(5) The hooked tool, or sliding wedge, is then inserted along the side of the puller bolt. (Fig. 262)

(6) Tighten the nut at the top of the valve seat puller stem. (Fig. 263)

(7) When it is desired to remove the lower valve seats only, first remove the sliding wedge from the puller assembly (fig. 262) and insert along the side of the puller bolt through the side cylinder head opening; or use the hooked tool as the size of the valve seat may require.

Figure 263. Loosening Valve Seat.

(8) Clean the surfaces of the valve seat and its tapered socket in the cylinder body.

(9) Drive the seat in place by striking a hard wood block held against the seat. (The block must fit inside the row of pins in the valve seat, and care must be taken not to bend or otherwise injure the pins.)

(10) Put the ball in place.

(11) Replace the top and side cylinder heads (caps).

c. Cylinder. The porcelain-lined cylinder may become worn or damaged and require replacement. Steps in disassembling the cylinder are as follows:

(1) First remove the side cylinder heads, intake valve balls, and piston rod nuts.

(2) Remove the inspection plate on the top of the pump. (Fig. 264)

(3) Remove the plunger assembly. (Fig. 255)

(4) Rotate the pump so that the piston rod shoulder

Figure 264. Removal of Inspection Plate.

is outside the cylinder and toward the power end.

(5) Insert the two-piece cylinder puller, made of cast iron and provided for this purpose, in the cylinder shell. (It fits over the small section of the piston rod in front of the shoulders, as shown in figures 265, 266, and 267.)

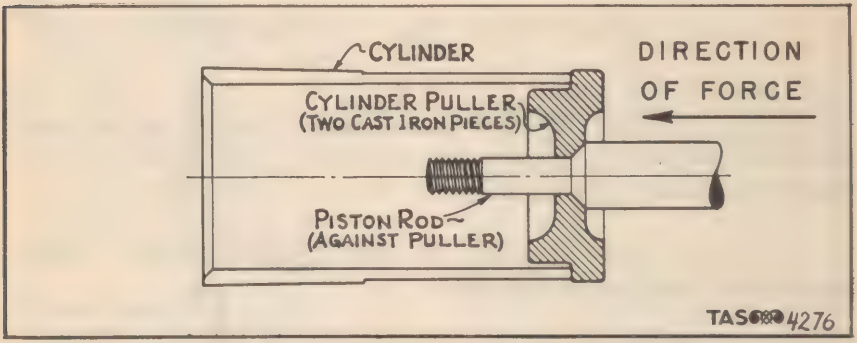


Figure 265. Cylinder Puller.

Figure 266. Placing Two-Piece Cylinder Puller.

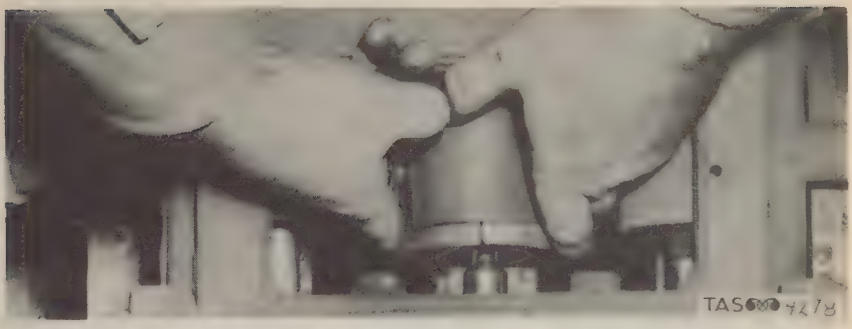


Figure 267. Cylinder Puller in Position.

(6) Rotate the pump so that the piston rod shoulder bumps up against the cast iron two-piece puller with some force. (This will bump the tapered cylinder shell loose and it can be withdrawn.)

(7) Withdraw the cylinder shell through the cylinder head opening.

(8) New cylinder shells can be installed by tapping on the end of a cylindrical block of wood about the same diameter as the outside diameter of the cylinder shell, which is held against the end of the cylinder shell after the shell has been put in place. (The block of wood must be held firmly against the shell and struck with several sharp blows of a fairly heavy hammer, otherwise it may rebound with each blow.)

d. Pressure regulator and unloading valve. Considerable corrosion of the working parts of this valve will occur after a period of time. It should then be disassembled and the parts cleaned and replaced when necessary. Steps in disassembly are as follows:

Figure 268. Disconnection of Unions.

Figure 269. Pressure Controller and Regulator with Tank Return Valve and Injector Valve and Assembly Removed.

(1) Disconnect the three unions shown in figure 268. (It is possible to disassemble the pressure regulator and unloading valve without disconnecting these unions, but this step provides greater accessibility.)

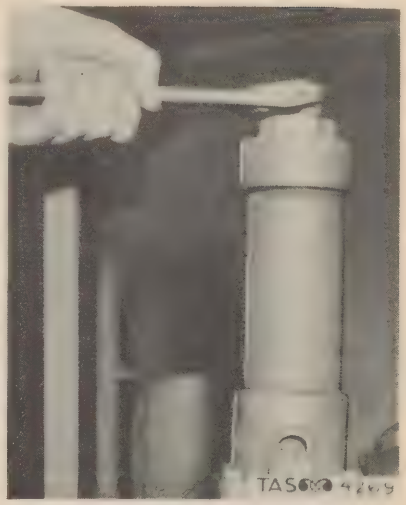


Figure 270. Loosening Adjusting Nut.

(2) Loosen the adjusting nut. (Fig. 270)

(3) Remove the retaining tube cap. (Fig. 271)

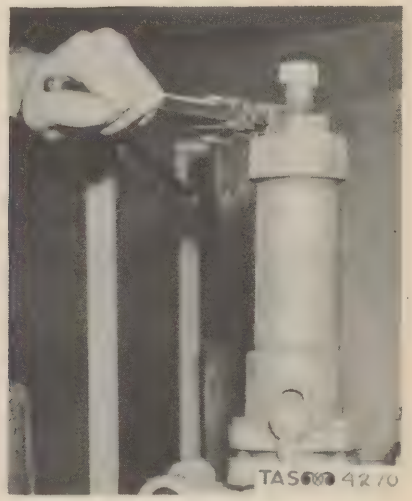


Figure 271. Loosening Retaining Tube Cap.

Figure 272. Removal of Upper Spring.

(4) Remove the upper spring. (Fig. 272)

Figure 273. Removal of Compression Spring.

(5) Remove the compression spring. (Fig. 273)

(6) Remove the yoke pin, employing any convenient tool for a punch. (Fig. 274)

Figure 274. Removal of Yoke Pin.

(7) Remove the bolts from the upper head. (Fig. 275)

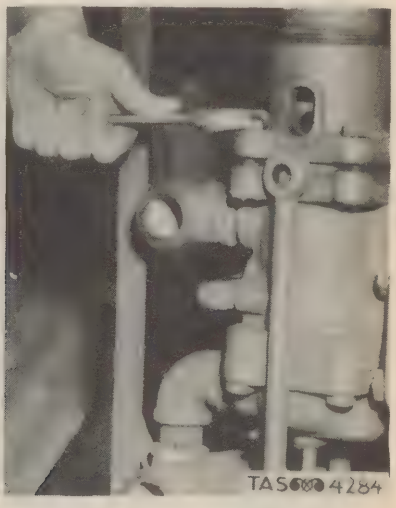


Figure 275. Removal of Upper Head Bolts.

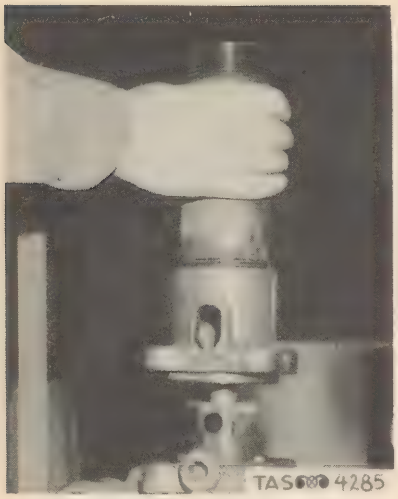


Figure 276. Removal of Upper Head and Spring Retaining Tube.

(8) Remove the upper head and the spring retaining tube. (Fig. 276)

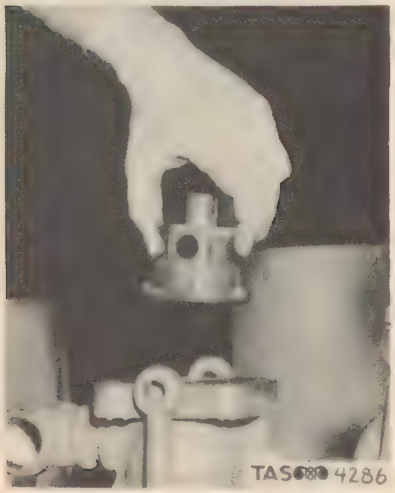


Figure 277. Removal of Plunger.

(9) Remove the plunger. (Fig. 277)

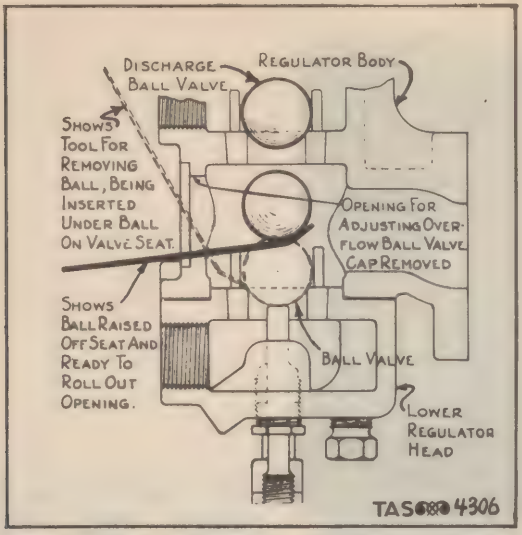


Figure 278. Method of Removing Lower Valve Ball.

(10) Remove the lower valve ball from the pressure regulator and unloading valve. This is done by removing the truss clamp (fig. 279) and the head (fig. 249), thus exposing the lower (overflow) ball valve (fig. 223). A special tool is furnished to remove this ball. The end of the tool is inserted underneath the valve ball, and the tool tilted so that the ball will roll out through the opening. (Fig. 278)

Figure 279. Removal of Truss Clamps.

Figure 280. Removal of Rubber Diaphragm.

(11) Remove the rubber diaphragm. (Fig. 280)

Figure 281. Removal of Diaphragm Plate and Washer.

(12) Remove the diaphragm plate and washer. (Fig. 281)

(13) Remove the discharge valve ball. (Fig. 282)

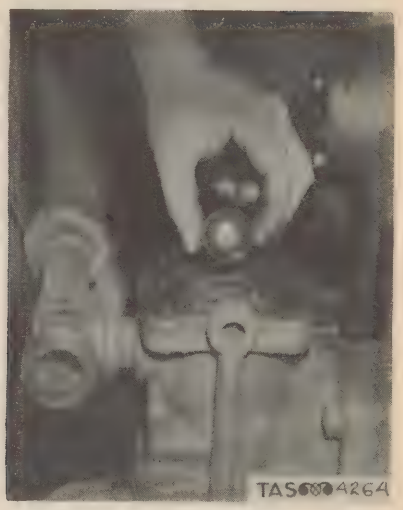


Figure 282. Removal of Discharge Valve Ball.

(14) The valve seats are removed in a manner similar to that shown in figures 261, 262, and 263.

e. Agitator paddles. Paddles may be removed by removing two bolts on each paddle. (Fig. 228) Some apparatus may be equipped with one-piece paddles which may be replaced in a manner similar to that described in paragraph 15 f.

f. Injector. The nozzle of the injector assembly will eventually become enlarged and require replacement. A nozzle is replaced as follows:

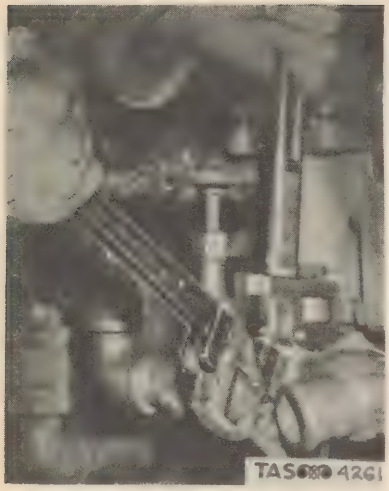


Figure 283. Disconnecting Injector Union.

(1) Disconnect the injector union. (Fig. 283)

Figure 284. Forcing Injector Valve Out of Way.

(2) Force the injector valve into the position shown in figure 284.

Figure 285. Loosening the Injector.

(3) Remove the injector. (Fig. 285)

(4) Remove and replace the injector nozzle. (Fig. 286)

g. Chains. See paragraph 15 g.

Figure 286. Removal of Injector Nozzle.

30. TROUBLE - COMMON CAUSES OF PRESSURE DROP.

a. General. The pump and all other parts of the equipment must be in perfect condition if the pump is to build up and maintain the desired pressure.

b. Failure to build up adequate pressure.

(1) Check the overflow from the pressure controller and unloading valve. If liquid is discharged through the overflow pipe and the pressure is below normal, the trouble is probably in the unloading valve. (Fig. 223) The valves and seats of the pressure controller and unloading valve should be examined. Unless the unloading valve ball seats tightly, liquid will be discharged back into the tank and the pump will be unable to build up pressure. Any parts in bad condition should be replaced. It may be possible, however, to correct this trouble by carefully cleaning the valve balls and seats.

(2) The pressure controller and unloading valve may not be properly adjusted. Make certain that the unloading valve is properly adjusted, as explained in paragraph 28 a. The plunger stem may be adjusted too high, thus keeping the valve ball off the seat all the time. The packing in the packing box on the plunger stem must be in good condition so that the stem can move freely.

(3) If there is no overflow from the unloading valve the trouble must lie elsewhere. The pressure gage may indicate the cause. For example, if the pressure is reasonably steady, the difficulty is probably due to low speed, enlarged holes in nozzle, air leaks in intake line or pump, or clogged in-

take strainer. Such a condition may also be caused by a leaky or partly closed tank return valve. Considerable fluctuation in pressure is probably caused by worn plunger cups or pump valves.

c. Failure to maintain pressure. This condition can be checked in the manner explained in paragraph b above. Generally speaking, this trouble is indicated by enlarged spray gun nozzles.

SECTION V

DESTRUCTION OF EQUIPMENT

31. When circumstances force the abandonment of chemical warfare materiel in the field, it is destroyed or rendered useless to prevent its use or study by the enemy.

a. Smashing. The M3A1 apparatus may be effectively destroyed by smashing. A heavy sledge-hammer should be used, with which the pump may be cracked open and broken and the pressure regulator, air chamber, clutch, power drive, valve, nozzles, and other mechanical parts made completely useless.

b. Demolition by explosives. Four 1/2-pound TNT blocks will destroy the pump and associated mechanisms. Two blocks should be attached to the front of the pump and two to the rear. Two blocks may be detonated along the side of the tank at a corner near the pump and thus demolish the tank. For a description of explosives and accessories, their use, and precautions requisite to their safe handling, see FM 5-25, "Explosives and Demolition."

c. Chassis and engine. The truck chassis and engine will be destroyed in the manner prescribed by the Ordnance Department.

[A. G. 062.11 (3-16-43).]

By order of the Secretary of War:

G. C. MARSHALL.
Chief of Staff.

Official:

J. A. ULIO,
Major General,
The Adjutant General.

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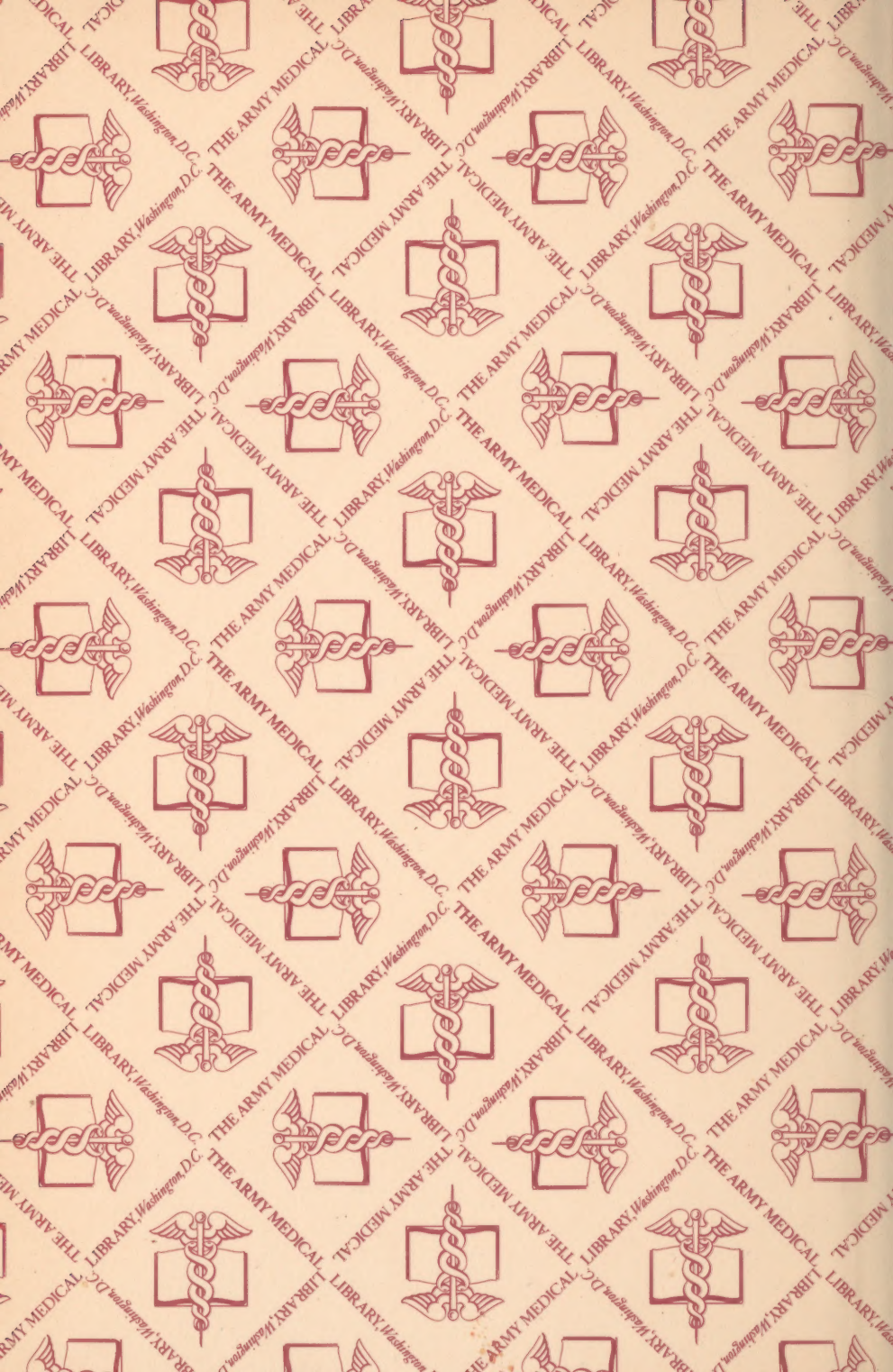
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